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ABSTRACT

Noting the increased use of microcomputers in commerce and the accounting profession, the Department of Accounting and Finance at the University of Manchester recognized the importance of integrating microcomputers into the accounting curriculum and requested and received a grant to develop an integrated study environment in which students would become familiar with microcomputer applications in business. The project's goals were to: (1) determine the areas where microcomputers could be effectively used within the accounting curriculum and to develop particular teaching applications; (2) evaluate commercially available software and select representative business applications packages; (3) create the databases for an integrated study environment in collaboration with local industrial companies and professional accounting firms; and (4) disseminate the case studies and accounting problems developed to other universities. This report describes the processes of information gathering, software selection, and courseware development, as well as the integration of computers into six accounting courses. Possible future developments are highlighted, and new educational practices necessitated by the integration of the microcomputer are discussed. The rationale for and methods of dissemination are outlined, and the evaluation of network installation, project implementation, and courseware is discussed. Appendixes include a list of courseware developed, a list of conference papers and publications related to the project, and acknowledgement of support provided by the university and other sources. (19 references) (GL)

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Final Report to the Computer Board

"Integrating computers into the accounting curriculum using an IBM Pc network"

September 1989

Dr. Jean Shaoul

Department of Accounting and Finance

Manchester University

This is the final report on the grant of £52,000 from the Computer Board to the Department of Accounting and Finance at Manchester University. It outlines the purpose of the project, how it was undertaken, its achievements and the impact it has had on this institution and beyond, our understanding of the issues and how this has changed as a result of this project. The purpose of concentrating on the process of the research in this way, rather than simply the results achieved, is to enable this report to make a contribution to the knowledge of the issues involved in integrating computers into the accounting curriculum.

For the sake of completeness, it is inevitable that this report will duplicate, or at least refer to, the interim report "Integrating Computers into the Accounting Curriculum" (Shaoul 1988).

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Chapter 1 : Introduction

For some years, accounting and business degree courses at Universities and Polytechnics have usually included a course on business data processing and/or management information systems where the objectives have been to teach students about the role of mainframe computers in processing large volumes of transactions and producing useful information for management. The emphasis has been on information systems for control purposes. Such courses typically included learning to program a computer because, it was reasoned, it was only by designing and writing a small system that students learned about the problems and issues in relation to computer systems. That is, the emphasis was on teaching about computers, how they are used, etc.

In the last decade, the advent of new, relatively cheap, user friendly technology and the associated software has created additional uses for automation in the commercial world. Whereas the mainframe computers performed work that was traditionally carried out by armies of clerks, i.e. routine transaction processing, microcomputers are appearing on the desks of managers to be used as a tool in their work. With the enormous integration of production on a world scale and the ever increasing domination of finance capital, the use of computers for planning purposes takes on a new significance.

Techniques that have been available for years on a mainframe, such as financial modeling, are now widely available. It is not simply that anything new, i.e. conceptually impossible twenty years ago, is capable of being done, but rather it is capable of being done by the many rather than the few. It is an important distinction to make because the cheap technology is only an enabling factor, it is not important as a thing in itself.

The types of software which are available on a micro mean that completely different uses are made of the microcomputer as opposed to the mainframe. The newer software such as spreadsheets, database management systems, graphics, expert systems etc, rendered possible by the microcomputer, are used for the communication and local analysis and evaluation of financial information, not just in multinational corporations, but also in small businesses. The emphasis is on the use of information for decision making in relation to future plans and, to a much lesser extent, control.

Given that these techniques are used in commerce and the accounting profession, it seemed essential to train students in their use, as an integral part of their accounting courses. If accounting students are to be adequately prepared for their subsequent careers, they need to be familiar with the new information technology. In the future it would be insufficient to rely on one or two computing courses within the accounting degree. The use of computers, i.e. Pcs, has to be integrated into the accounting curriculum.

However, the shortage of resources available to the Department of Accounting and Finance and the University in general in 1984 meant that it was an objective that could not be realized for the core accounting courses in the second and third year of undergraduate study. Such computing as was taught,

was of necessity based on the mainframe. (In the first year, all the students in the Faculty of Economic and Social Studies take a common course of study. Thus there are nearly three hundred students taking the introductory accounting course in the first year. It is only in the second year that the accounting courses are restricted to those specializing in accounting.) Thus it was only feasible for the specialist courses in the third year, where student numbers are smaller, to achieve this objective. An application was made to the University therefore for funds to purchase the necessary additional hardware and software.

The University directed our attention to the fact that Computers in Teaching Initiative programme (CTI) was being funded by the Computer Board for Universities and Research Councils (CBURC) and the University Grants Committee (UGC) to encourage the use of computers within University courses. It was understood to be a pump priming exercise. The Department therefore applied, in 1985, for a grant to the Computer Board/UGC for the resources to enable computers to be integrated into the accounting curriculum.

CHAPTER 2 : Purpose of the Project

The purpose of the grant was to equip a computer laboratory with IBM Pcs locally networked to a hard disk and printers. This hardware would facilitate the development of an integrated study environment in which students would become familiar with microcomputer applications in business, gain experience of commercially available software and use information technology as an aid to learning. **A suite of applications software, together with suitably constructed databases** would enable students to apply the concepts and techniques that they study in a variety of courses.

The Department had recently undertaken a preliminary study of computer applications in UK accounting firms which are the major employers of accounting graduates, in order to evaluate the implications for the use of computers in undergraduate teaching (Shaoul 1988a). The project would proceed in collaboration with these firms to ensure that teaching kept pace with developments in practice and in order to evaluate its success in adequately preparing students for accounting careers.

The project would make two particular contributions:

i) The areas where microcomputers could be effectively used within the accounting curriculum would be investigated and particular teaching applications would be developed. Commercially available software would be evaluated and a representative suite of business applications packages would be selected. The databases needed to create the integrated study environment would be created in collaboration with local industrial companies and professional accounting firms.

ii) The case studies and accounting problems which were developed would be made available to other Universities. The particular emphasis on microcomputers distinguishes this project from developments in some other departments of accounting where mini-computers have been used. In addition to the improved response rate and the quality of user interface, microcomputers have the advantage of supporting a wider range of business applications software and permitting widespread exchange of teaching materials.

The request to the Computer Board/UGC was for funds to purchase the hardware and software. The University was to provide both the financial resources to install and maintain the computer network and the human resources - its staff - to develop the relevant software and course materials.

In February 1986, the Department learned from the University that the request had been approved by the Computer Board. In fact this was only discovered accidentally many months after the University had received information that the bid had been accepted.

Fifteen IBM Pc XTs and two IBM Pc ATs which were to act as file servers to the XTs were purchased. These were delivered in April 1986. The University of Manchester Regional Computer Centre (UMRCC) were to install the network and the cost was to be borne by the University. Because of their enormous backlog

of work, this was not completed until March 1987.

This meant that the effective start up of the research project, from the teaching point of view, was October 1987, two years after the Computer Board had approved the project and one year after the expected start date. The causes of this have been outlined more fully in an earlier report to the Computer Board (Scapens 1987).

CHAPTER 3 : Method

This chapter describes briefly the way that information was sought about the uses of computers in the accountancy profession both here and in the US, the way that Pcs were being used in the Business Schools in the US, the kinds of courses, software used, etc., and the different forms of existing teaching materials which could be used here. The selection of software and the general philosophy of the Department with regard to the development of courseware is explained.

3.1 : Information gathering

A preliminary review of the microcomputing packages used in business, to see how the new technology was affecting the Accounting profession and how it was being used in industry had already been undertaken. Microcomputers are a fact of professional life in the accounting/auditing profession. They play a major role in such auditing activities as adjusting journal entries and consolidations, and in such tax services as estate planning. Virtually all the major firms are committed to developing their own accounting and microcomputer support systems. Some write their own software, while others base their systems on commercial packages such as Lotus 1-2-3. Discussions with the most of the "Big Eight" Accountancy firms and some of the smaller firms to ascertain the main ways that computers (of all types) are used by the Accounting profession in the UK and also the types of software that are used, revealed that a major use was for their own internal administration, e.g. time allocation, electronic mail, word processing, etc. Other applications stressed number crunching e.g. consolidation of accounts, foreign currency translation, leasing, etc., which would not typically be taught in great detail at British Universities.

The vastly reduced costs of computers meant that they can be widely used in the auditing task and that auditing, a labour intensive task, can be automated to some extent. Computer usage was increasing and was expected to continue to increase. All firms had a computer audit team who took responsibility for the computer audit. Previously, computer usage (mainframe and minicomputer) had been restricted to this group, but now with the new technology, all this had changed and microcomputers were being purchased for use by all the staff. Further more it was being used by individuals as a tool, as part of their work, not as their sole task.

Interestingly enough, while all levels of staff were being trained to use computers, the nature of the applications meant they would be used predominantly by the less senior staff. This is in part due to their greater acceptance by younger staff and in part due to the nature of their work.

It was widely acknowledged that computers save a great deal of time and therefore are important in cost cutting. Computers were therefore increasing the productivity of the more junior staff who work on the "production line" tasks of auditing. This in turn is a consequence of the increased competition for auditing work. Ultimately this must mean a reduced demand for trainee auditors, other things being equal.

The main value of this survey was to highlight the wide range of uses to which computers were being put since the advent of the microcomputer and user friendly software. This is shown in Appendix I. In addition to auditing and administration, computers were being widely used for tax, cash flow forecasting, consulting work and general advice to clients. This is a consequence of the changing nature of accountants' work away from auditing to consulting and other financial work.

This survey showed that there are many applications of computing in accounting and business. However many may not be useful from an educational perspective, i.e. some applications are useful in the world of work and are even useful in reducing students' work load, but may actually eliminate a procedure that has learning value.

Most of the "Big 8" firms expressed their interest in the development of this project and offered to help in a very concrete way. Several firms offered their training programs in computer auditing and microcomputing applications to members of staff who were interested in attending. (Peat Marwick McLintock, Binder Hamlyn, Arthur Anderson, Arthur Young, Deloitte Haskins and Sells.) Deloitte Haskins and Sells, also provided money to establish a library of computing journals within the Department of Accounting and Finance. Some of the firms, most notably Coopers and Lybrand, were willing to let the University have copies of their audit software, especially if good teaching case studies were designed to make use of them.

Touche Ross had expressed an interest in the project and made a substantial contribution towards funding a member of staff to visit the US, to review the use made of computers by the accountancy profession and in the Business Colleges, and to assess their implications for the development of Accounting education in the UK. The opportunity to attend conferences and courses, and to acquire books, software and other teaching materials was invaluable.

Thus, similar discussions were held in the US about the use made of microcomputers by the accounting profession. While they had had a greater experience in using microcomputers, and were more advanced in the use of computers, particularly the development of expert systems, the general picture was not substantially different to that in the UK.

However their involvement in accounting education in the Business Colleges was markedly different to this country. Several of the accounting firms are devoting significant resources to this involvement, most notably Coopers & Lybrand, with their Accounting Curriculum Development Program, Deloitte, Haskins and Sells, with their Audit and Plus Plan software, and Price Waterhouse with its educational Accounting Practice Support System. Peat Marwick McLintock are funding the development of computer case studies. Many of the large firms also have significant research funding programs for University staff.

The Business Colleges were often using the mainframe computers for teaching programming. Usually, they were teaching a general foundation course in programming rather than a course specifically geared to the needs of

accounting students. i.e. The issues involved in transaction processing and information systems were not necessarily covered. Many teachers raised the question of the wide range of needs which such general courses had to serve as being a problem. Many felt that the situation was improving as these courses were no longer being taught by a department of Computer Science, but by a department of Information Science which tend to be more application orientated. Furthermore, departments of Information Systems were being increasingly located in the business colleges rather than with Computer Science, and Information Science teachers were to be found in Accounting departments. But the relationship between Information Science and Accounting is an ill-defined one. In some Universities, there are two departments, in others, they are combined.

Microcomputer labs were available for students' use. Many had hard disc systems but all had assistants on hand to help with administration and to give students help with the software. The labs were often open 6-7 days a week, for up to 12 hours a day. The most commonly used packages were Lotus, dBase, word processing, linear programming, SPSS, project management and expert systems. All of them came with self teach tutorials. In addition to microcomputers being available in the business colleges, there were usually other Pc clusters elsewhere. Most libraries had Pcs available for word processing and other software. Dormitories were similarly equipped and students were encouraged to buy their own computers.

The accounting courses involved much more extensive use of computers than courses in this country, including computer based exercises and case studies, drill and practice sets as well as assignments which required students to develop their own templates or amend existing ones. Their courses are much more technique orientated than in this country and consequently lend themselves to a greater use of computers. Auditing courses would include a significant use of dBase to check, say, the payroll file. Increasingly, plans were in hand to offer a software tools course which would show students how to use a spreadsheet, a database management system and a word processing package. In such courses, the emphasis was purely on teaching the key strokes rather than the design issues, validation of the model and security.

Many textbooks were accompanied by discs with spreadsheet templates or database files. Such templates are of two types - those with the formulae and those without. The educational value of the former, where that is the sole means of learning the technique, as opposed to a sensitivity analysis (or a what if calculation?) <u>after</u> the students have learned to perform the calculations manually, is not at all clear.

There was little discussion among accounting faculty about the educational issues involved, the objectives, design issues in courseware design, as teaching is not given a high priority. As in the UK, the reward structure does not encourage the development of teaching at the expense of research. The Community Colleges and the less well known Universities are more interested in this area as witnessed by their attendance at conferences on this subject.

However the Department of Education, both at the Universities of Cincinnati and Minnesota did run courses on computers in education and were interested in

the issues involved in integrating computers into the curriculum. They were much more interested in explaining and illustrating recent developments in this area, than were the accounting faculty.

At the same time as these surveys of the use of computers by the accounting profession in the UK and the US, we obtained information (via the published literature, conferences, etc.), about the computer applications introduced by other Accounting Departments and Business Colleges. Most of these sources were American and given the more vocational and technical nature of the US courses and the financial constraints on UK Universities, many did not seem relevant to our courses here. Furthermore, the articles were frequently prescriptions as to what should be done rather than an analysis of what they had done.

In Britain, it was only the University of East Anglia which had any substantial experience in integrating computing into the curriculum, (Bhaskar 1983) and this was using a mini-computer. Few of the academic accounting and business journals published articles relating to the use of computers in accounting education. Informal discussions with accounting teachers revealed that their emphasis was on teach yourself book-keeping. The Polytechnics were heavily into this, having more resources and a course structure that emphasized vocational training.

We also tried to ascertain what members of the Department of Accounting and Finance would like to see taught. This was less easy as few understood the flexibility and power of the new software and its applications and implications for teaching. Furthermore there was little in the way of really useful in the way of courseware to demonstrate to them. Classes were organized to show them how to use spreadsheets, databases, word processing, etc. Most agreed about the potential usefulness of spreadsheets, but none were prepared in practice to alter their course material or assignments.

Discussions were held (informally) with students who were taking the optional third year courses in management accounting and information systems where computer assignments were a significant part of the course. The nature of the subject and the type of assignments set lead to a much closer relationship with students than is usually possible on other courses. Most of them were extremely responsive to questions raised about innovations in the accounting curriculum, volunteering their opinions and learning experiences. Many were of the opinion that a course in Accounting Information Systems, application software and information technology was absolutely essential. Some raised the point that it should be made compulsory. Most of them enjoyed working in groups and doing project work (Newman, O'Hara, Shaoul 1988). Several felt that the second year programming course did not adequately prepare students.

3.2 : Software Selection

Nearly all the Accounting and Finance courses in the Department could, in principle, make use of computers for their assignments, particularly Finance and Management Accounting. The most widely used software in these areas are spreadsheets and data base management systems. It was decided to purchase the packages which are most widely used by the profession, (Lotus and dBase III+) despite the cost, since it provides the most realistic working environment and

the greatest flexibility in exchanging data files and software rather than the cheaper versions that were available or those in the public domain. At the start of the project, no other department within the University was using this type of software for teaching and the University did not have a central purchasing policy.

Spreadsheets can be used as a calculating tool and for building models to simulate processes. They are particularly useful for the presentation of data, having graphical output. Furthermore, Lotus has a very rudimentary programming language which permits software to be designed that does all the "housekeeping" (data validation, file storage and retrieval, calculation, printed and graphical output) for the user without the user having to know how to use Lotus. Other well known packages, such as Supercalc 4, are probably as suitable. A similar decision taken now would depend very much upon which package the University as a whole had decided to standardize upon, site licenses, etc.

dBaseIII+ can be used for database enquiries, the selection and processing of data and as a calculating tool. A further advantage of dBase, in comparison with some of the other database management systems, is that is a powerful programming language in its own right and therefore has several different types of applications within the educational context. Unlike spreadsheets where there are several rival packages, only this database system currently suits all our requirements.

Other widely used software includes statistical analysis packages such as Minitab and SPSS. SPSS is available on the mainframe and is too sophisticated for the types of problems set for our students. Minitab has some useful functions, e.g. regression, and interfaces easily with Lotus. As it is of use in the first instance on an optional third year course, only a few copies were bought at the beginning of the project. Since then, it has become more widely available within the University.

Other potentially useful applications include linear programming and expert systems. However since these are available on the mainframe, it did not seem necessary to purchase copies for the network in the early stages of the project. One copy of an expert system (EXSYS) was bought for exploratory purposes and for the third year Computer Science and Accounting projects course.

The commercial "Teach Yourself Accounting" software were reviewed, but most of it was simply page throwing which offered little from an educational perspective. One major area of development that has seen a lot of effort devoted it to by other Accounting teachers is "Teach Yourself Book-keeping" in one form or another. At the time when the project started there was little that was complete or very satisfactory from an educational point of view. Since then however, several packages are on the market. **An extensive review of them still requires to be done**, but the immediate impression is one of confirmation of the adage that the ability of a teacher to program doesn't necessarily result in good educational software. The main criticism is usually that the screens are so cluttered that it is very difficult to concentrate. In relation to the work in the Department, it was not thought to be useful since

it was material that is covered in the first year course which is outside the remit of this project as earlier described. However, it is an area which is becoming of interest to us as more resources are becoming available.

At the start of the project, the only textbooks which were available with software were American and were therefore usually not suitable for courses here. Increasingly, textbooks are being published with software in this country and this may well prove to be a useful way to acquire teaching materials in the future. The courseware usually requires Lotus and dBase. However, given that Accounting courses in this country do not rely on one standard textbook per course, this path may have limited applicability here. **Again, an extensive review of the software accompanying textbooks, their educational, computing and accounting features, is required.**

Authoring systems such as PLATO and MAS suitable for designing teach yourself packages on Pcs were available elsewhere within the University and recently a site license has been obtained for MAS. There was therefore no need to purchase any copies. It was intended to investigate their use as a teaching aid.

Consideration was given to purchasing an accounting package such as an incomplete records package which could be used for setting exercises for financial accounting. While it seemed in principle of interest, the cost was too great. It is highly likely that some similar package could be acquired from one of the professional firms free of charge.

This raises an important issue in relation to the development of computer based case studies and exercises. There is a need for access to a range of software on an exploratory basis in order to review it and to see what kinds of teaching applications can be designed. Some software could be obtained from the firms. Sometimes it is possible to obtain "cut down" or demonstration versions from the supplier.

The University has standardized on the use of PcWrite, a word processing package in the public domain, for student use. This package is available on all the Pc clusters throughout the University. This package was therefore installed on the network. This is nowhere near as easy to use as a commercial package, but even if we could have afforded such a system, it would not have been possible to install it on the rest of the University clusters.

This selection of software was seen as the primary requirement. It could be expected that as the project developed, different types of software would also be required. **However, in the immediate future there is a need for a small budget to enable "one off" purchases to be made.**

3.3 : Development of Courseware

In accounting, there are several conflicting reasons for using computers in teaching - namely the need to teach students about I.T. and how to use it, (computer literacy) accounting information systems (teaching about computers) as well as to demonstrate accounting principles and concepts (teaching with computers).

The purpose of the grant was to equip a lab with Pcs and the kinds of software which would enable the students to use computers as yet another study resource. In the first instance, the Pcs would be used on those courses which already had some element of computing in them - namely AC 200 Computing which taught basic computer literacy and information systems, AC 307 computerized accounting systems, AC 305 management accounting which used computers as a tool to demonstrate principles and concepts and CS 301 computerized accounting systems. As the previous sections have shown, it was not possible to use existing courseware either from the textbooks, US or UK courses or any other source. Not only did there appear to be an enormous lack of educational materials in this area, there was an even greater lack of any easy means of finding out what, if anything, was available, its uses and limitations. As Bork (1981, 1985) explained, this is not unique to accounting, but is consequent upon the stage of development of instructional computing. Therefore course material would have to be developed which would more adequately reflect modern day use of computers and their applications, using the newer software tools, than was possible on the mainframe. In the second place, software and datasets would have to be developed/obtained for those courses which did not at that time use computers. **Thus to a large extent we were starting from "Square One" in terms of courseawre development.**

In general, those teachers wanting to use computers in their teaching were not interested in using/developing computerized assisted learning packages. Some were interested in using computers as a giant calculating tool in problems where the calculations were laborious and trivial and where the issue was to see the impact of changes in the different variables on the solution. This would enable the class to deal with and discuss material that it was not possible to do without a computer.

Others were interested in the potential for using "real" data sets as opposed to the contrived data which had to be used to keep the calculations manageable. This would imply the development of data sets and spreadsheet templates to solve problems. Furthermore the availability of on-line databases of financial information means that students can use the computer to analyse and evaluate the data, using the techniques they have been taught in class and see for themselves the advantages and limitations of different analytical techniques and theories. In this case, students might use commercially developed packages such as Minitab (to do regression analysis) or Lindo (to do linear programming). The aim therefore was to prepare course materials which would develop the students' analytical and problem solving skills.

It can be seen therefore that the approach was one of preparing materials which could be use to explore/cover one topic or issue in an existing course rather than of remodeling the whole course.

While there are very general guidelines available in the textbooks and research articles for the design of software, there was little available at the start of the project for educational software which was not computer assisted learning, and even less that was relevant for Higher Education or Business Education. Clearly then, any software development would, of necessity, be exploratory in nature, and undertaken with a view to

understanding the design issues involved in educational software. Several different approaches and software tools would have to be evaluated.

The development of computer based course material requires at least two kinds of input, firstly from the accounting teacher who has to design the tutorial exercise/assignment and secondly from the computer personnel who write the software. As the project relies on the University to provide the resources to develop the software, this means that that these are very limited.

Apart from the staff directly involved in the project, (Dr. J.Shaoul who is responsible for the course ware development and Mr. M.J.O'Hara who is responsible for managing the network and technical support) there is also a Research Support Unit in the Faculty whose staff can help with software development, but this too is an overstretched service. While initiatives have been started within the University as a whole via the Staff/Teaching Workshop to set up user groups for different types of application software and to pool software and ideas, this has not as yet provided any material gains in terms of course materials. Help with data and data files, often a major problem for work of this kind, is obtainable from the professional firms and is invaluable.

Given the lack of computer personnel to develop the software, third year students on the joint Honours degree in Computer Science and Accounting were encouraged to take on the development of such courseware for their third year projects. This would enable far more to be developed since they were expected to spend between 60-100 hours on their projects, and preferably to work in groups of three. The use of students to develop software meant that it would be possible to explore the use of different approaches, different software tools as they came on the market and different designs, etc. to accomplish the same task and build up our expertise in this area. It would mean that we would not feel obliged to pursue or use a particular piece of software simply because we had expended so much time and energy on it. Much of the software developed by teachers is very mediocre and would never have been used at all if they had not committed so much to it.

Thus it was apparent from the start that courseware development would of necessity take place in an amateurish and empirical way. It had to be seen as an exploratory process. It was envisaged that it might be of more use for the ideas generated than its implementation. Furthermore such an approach would enable us to look at the different ways computers can be used in teaching.

Ch 4.1 : Results

This chapter describes the way that we attempted to fulfill the first objective of the project, namely the development and use of the software and databases. At the time of writing, the system, as a computer **network**, has been used for two academic years. It has been used for teaching **about** computers (computerized accounting systems, programming, the software tools that are used in business, etc.) and teaching **with** computers, using the software tools to apply the concepts learned in the accounting courses. It is, to some extent, difficult to distinguish between the two types of instruction since students have to be taught **about** computing in order that they can be taught **with** computers, given the complexity of the software tools.

The following sections describe the way that the network has been used to integrate computing into the accounting curriculum and future developments that are planned, the educational and pedagogic issues that follow from using computers in teaching and the development of different types of courseware which can subsequently be used. Given that its design and development is itself part of the curriculum, the three are not as separate and distinct as might appear at first sight.

4.1 : Integration into the curriculum by course

4.1.1 : AC 200 Computing and Finance

The main vehicle for teaching students about computers and how to use the software tools that will enable computing to be integrated into the curriculum is the compulsory second year course, consisting of two modules, Computing and Finance. The computing module is a one term course. There are about 100 single honours Accounting students, 15 Law and Accounting students and 35 Computer Science and Accounting students, making a total of about 150 students. This course is not available to non Accounting students.

The computing part of the course was taught for the first time using Pcs in October 1987. It aims to introduce students to such issues as system design and specification, BASIC programming, data validation, usefulness of reports and the control and security of computer systems. The role of the accountant in all these areas is emphasized. Students are required to write and test programs since it is reasoned, it is only by designing and writing a small system that students gain an appreciation of of the problems and issues in relation to computer systems, the strengths and weaknesses of computers and whether errors made by computer systems are generated by the designer, data input clerk, operator or user of the output of the program.

In 1987-88, the students were given class assignments that attempted to integrate the two parts of the course, computing and finance, i.e. they were asked to write programs in BASIC to solve the finance exercises as well as the more usual business data processing exercises However, this was not well received and was abandoned the following year.

For 1988, the course was redesigned and started by discussing the role of the

accountant in relation to the provision of information in a business for the purpose of both planning and control. Students were introduced to the concept of decision support tools and were shown how to use Lotus. Keystroking was taught via a tutorial package supplied by the software company.

The lectures concentrated on the design of templates, the use of a diagonal layout, separation of data, calculations and output, model validation, testing, documentation, security issues, etc. Since all the spreadsheet textbooks stress keystroking, it has been necessary to write course material and exercises which focus on these issues.

Since students are using computers as an aid to learning accounting techniques and design and security concepts, and because they will be using computers so frequently in their working lives, they should be encouraged to become as conscious as possible about the computing issues, e.g. the design of the spreadsheet, instructions, output layout, etc. Questions can be included for the students to think about during the working of an exercise which has involved the use of a predesigned template. For example, they can be asked about the measures that can be taken to check the accuracy of templates and whether in the process of so doing, they found them easy or difficult to verify and why. This is an approach used in one Management Accounting textbook published in the US (Collins 1985).

The question is then raised about the kinds of information that are needed by management to make decisions about inventory levels, the accuracy and reliability of the data used in such plans, their source, etc. It is at this point that routine transaction processing is discussed and the role of accountants in specifying and implementing the system, training users and maintaining its security.

Students were given exercises in BASIC which covered the range of computer applications in business and management and within the sphere of business data processing specifically: data validation, production of well designed business reports, file handling and the updating of files in both sequential and random access mode (Appendix II). The students are currently taught the BASIC programming language because it was, until recently, the easiest to teach in a short space of time, widely available and cheap. Despite its limitations, it serves as an introduction to the concepts and issues. They are not going to be required to program again. The method of teaching is to give them an outline of some of the most elementary aspects of programming and as far as possible require them to alter existing programs. Once they have mastered the basic programming techniques, they can look up the more advanced techniques for themselves. Plans are in hand however to use dBase III+ in 1990-91.

They were also shown how to use the word processing package, PcWrite, so that they could write up their assessed essays on the word processor. Thus this course, by introducing them to information technology, gave them some knowledge of the operating system MsDos, the relationship between files, programs and data, the BASIC programming language, the Lotus spreadsheet package and word-processing. It was hoped that in this way, the other accounting teachers would not have to concern themselves with instructing

students in the use of computers when they were themselves using computers for teaching.

The computing part of the course was assessed by means of two pieces of work, a project and a prepared essay, based on an economic model of the costs of a plant closure in the first year and a stock management plan in the second year, written in examination conditions.

The project required the students to join together four programs that formed the skeleton of a stock recording system, amend it to improve the user friendliness, data validation, the usefulness of the reports, the security of the data files and build in an audit trail. An important part of the work was to document their system and to write a review of the controls within the system (Appendix III).

The Joint Honours students in Computer Science and Accounting were shown how to use dBase III+ (Appendix IV) rather than BASIC and were expected to design the stock recording system *de novo* (Appendix V). They were however shown the skeleton stock recording programs.

The second part of the course assessment required the students to input data to a Lotus model of the costs to the community of a planned redundancy, assess the advantages and limitations of the model as a decision support tool for local government. Thus it gave the students the chance to use a much larger and realistic model than they could expect to build themselves, to study the interrelationships of variables by altering the parameters and the application of computing to an area to which they would not normally be exposed (Appendices VI and VII).

In 1988-89, the second part of the course required the students to make use of an inventory database of a small engineering company that has the same file structure as the one they have been working on, to prepare an inventory management plan (Appendix VIII). That is, to make use of information derived from control system for planning purposes, using dBase III+ in enquiry mode and Lotus. The purpose is to illustrate the integrated nature of corporate data, the concepts of file interrogation and transfers and the use of internally generated data for planning and control. Thus the course has come a full circle and has covered most aspects of the use of information in accounting as well as the most well known software tools.

The computing part of the course therefore required the preparation of four types of software and supporting course materials:

Data files for the class exercises.
Programs and data files for the stock recording system.
The model of the costs of the plant closure.
Database for the inventory management plan.

Although such a course is primarily concerned with teaching about computers and information systems, the new technology means that such a course can be more closely integrated into the core accounting curriculum and its relevance becomes more apparent to the students. It is also the course where the

students learn the basic computing skills required for using computers on their other courses.

The development of this courseware has aroused some interest and is the subject of a paper presented at conferences and to be published in monographs, both in England and Canada.

4.1.2 : AC 202 Management Accounting

This second year course which most students take in their second year and some in their third year, is a core accounting course. The course is designed to demonstrate how management accounting may be used for planning and control of organizations. The course covers both management accounting techniques and the provision of information for management decisions. The course has only been in existence in its present form for two years and is still being developed. In particular, attention is being given to the development of teaching materials and methods better suited to the aims and content of the course than traditional tutorial questions. Increasing use is being made of case study material and during the academic year 1987-88 an initial attempt was made to introduce computing into the course.

However, as it was the first year that the system was being used, it was not clear to what extent the resources were adequate for more than one exercise to be set requiring the students to use computers. The network was the only site within the University where the students had access to Lotus. A small project appraisal exercise was set. A copy of the exercise is included in Appendix IX to this report.

Thus the computing did not require development of any software. The students themselves used the computer to apply the concepts they had acquired on the course. Although the project was not part of the formal assessment of the course, a question based on the project was included in the end of year examination paper for the course, thereby introducing some indirect assessment. All students on the course submitted a project and the overall performance was good and there was evidence that many students had improved their understanding of management accounting as a result.

It had been intended to introduce computer models for various parts of the course which students could use to illustrate different management accounting techniques. However in 1988-89 this approach was delayed pending the development of the management accounting database.

The major area of development of courseware for this course is a management accounting database consisting of monthly management accounts for one year to enable the management accounting course to be orientated around a real business and the decisions it has to take. It has been possible to obtain, with the help of one of the major accountancy firms, the records of a carpet manufacturing company, long since taken over, which has several product lines, cost centres and two operating plants at different locations. The idea is that the students would themselves select and "pull down" the data they need to solve the tutorial exercises from the computer's data base.

The students would not necessarily use the computer to solve the problem. The issue, as many accounting teachers see it, is that from an educational point of view, the students have to learn to calculate a particular technique manually, without the aid of a computer in the first instance. In any event, in real life, the problem is often one of selecting the appropriate data in the first place. Until now, teachers have had to give students the data.

The program to generate the budgeted and actual profit and loss accounts and the teacher's information retrieval system has been developed. The information retrieval system for students to use has still to be designed. Extensive documentation relating to the database has been produced (Appendix X). It is a major development, being undertaken with Peat, Marwick, McLintock, and has taken some 800 hours to develop - being in effect a management information system for a firm.

Some tutorial exercises are being designed that make use of the database to pull down the relevant data and export it to the relevant spreadsheet for basic costing and cost classification, and marginal costing. The aim is not to teach computing but management accounting in a realistic setting. Further data are needed to allow the system to cover all the topics taught in the second year course. This development has met with an immediate response and we have been able to secure additional funding, from the Association of Chartered and Certified Accountants and the Department and consultancy help from Peat, Marwick, McLintock which will enable the two students who worked on the project to be employed as research assistants for twelve months to complete the database so that it can be used on both the second and third year courses.

It can be anticipated that this will change the teaching methods used, etc., and will be of interest to other Universities. The intention is ultimately to expand the database, to suit the requirements of other courses such as financial reporting and finance as the teachers understand the implications for them.

4.1.3 : AC 305 Management Accounting

In this third year optional course, students work through a case study which comprises some six to eight sections through the course of an academic year. The sections build together to form a case study which analyses a variety of aspects of management accounting. It looks at economic, organizational and behavioural issues. The basic financial material for the case is contained in a Lotus model which students can access throughout the year (Appendix XI). At the start of the case, students are required to produce a sales forecast and budget for the coming year. As the case progresses, they are expected to utilize the information available in the model in order to analyse particular situations that arise in the business. For instance, at one stage in the year, following a fire in the factory, it is necessary to revise the objectives and the students use the existing information together with a linear programming package in order to optimize the remaining production capacity.

The important aspect of this case study is that it comprises both the financial aspects of management accounting and the organizational and behavioural issues that arise in the day to day operations of a business.

Although particular sections of the case may be concerned primarily with a behavioural issue, the background financial information enables the students to understand the link to management accounting. We believe that this particular aspect of the case has been particularly helpful in integrating students' understanding of the various aspects of the subject and this is shown in the quality of the answers they give to examination questions.

4.1.4 : AC 307 Computerized Accounting Systems

This optional third year course builds on the systems analysis and design material covered in the computing part of the AC 200 course. It consists of two projects, worth 50% of the marks, and a normal examination for the other 50% of the marks. As a result of the changes made to AC 200 outlined above, 40 students have done the course in 1988-89 and the numbers are expected to increase.

Specific computing input consists of:-

(i) All students are introduced to Lotus, dBase III+ and PcWrite if they have not used them before.

(ii) The feasibility studies which the students do in groups as the first term's project, have to use Lotus or equivalent to do sensitivity analysis, etc. (Appendix XII)

(iii) All work handed in has to be word processed.

(iv) All students attempt to run a computer auditing case study which involves running test data against a banking system. This case study was supplied by Arthur Young.

(v) Students are given the chance to use Lotus or dBase III+ or other software for their optional project in the second term. One student wrote a joint cost allocation model in 1987-88. In 1988, the take up of this option was greater because the students had used Lotus before.

The software topics undertaken in 1988-89 are listed below :

(1) A Review of Accounting Courseware - The purpose of this project was to evaluate a number of different types of software on a wide range of criteria which would permit a prospective borrower of software the opportunity to sort through a directory of software and find software relevant/appropriate to his/her course.

(2) An Investigation into Moving Averages using Lotus 1-2-3 and Datastream. The project aimed at addressing a number of questions regarding the theory of moving averages and attempts to go some way to answering these questions by applying the general method to historic share prices obtained from an on-line financial database over a ten year period.

The key questions were :

(i) Can future abnormal returns be gained by applying mechanical filtering rules (in the form of moving averages) to ex-post share price data?

(ii) What is the optimum period over which the moving averages should be calculated?

(iii) What are the implications for capital market efficiency?

(iv) How does the method perform in the period of high volatility such as the '87 stock market crash?

This analysis involved selecting the data to be analyzed from the on-line financial database, Datastream, downloading it to the network and developing a Lotus template.

(3) A Stock Control System - This was written in dBase III+.

(4) Impact of Interest Rates on Income Distribution.
The development of a Lotus model to be used by first year Economics students to illustrate the link between the distribution of income in the UK and the prevailing interest rate. The intention was to help students who have difficulty grasping the mathematical subject of elasticities of demand and supply. By putting it in a more realistic setting, the concept would be easier to grasp.

(5) A Comparative Advantage Model
This uses Lotus and was developed as a teaching aid for first year Economics students. It is a practical example of the economic theory of comparative advantage, i.e. goods should be produced where resources are used more efficiently. If we assume a situation exists where two countries produce two commodities and there are no barriers between them, trade arises because of differences in opportunity cost or comparative advantage in the production of the commodities. The countries will produce and sell those goods in which they have a relative advantage. By complete specialization in the production of this good and exchanging the surplus for the other product it requires, the firm and the country will gain. Even when a country has an absolute advantage in the production of both goods, it can still gain from trade.

The nature of this theory means that it is best explained by practical examples and diagrams. The model starts off with a simple worksheet demonstrating the principles. It also contains a more advanced worksheet to allow experimentation. As the production of a commodity increases, so profit falls due to diminishing returns and the increased opportunity cost of the output foregone of the other product. The user can add his or her own data into the model and obtain a solution, adding greatly to the learning process. The user enters data into the formula and then the model produces the results with graphical output.

Students are given a "shopping list" of topics they can do for members of staff - work that can be used in subsequent year's teaching and is of interest to the students. But they are not restricted in their choice. The course encouraged students to use computers to solve a realistic problem for a "customer". At the same time, it produced two valuable pieces of software which have already been used in Economics teaching to the satisfaction of both the staff and the students.

Thus again this course did not require the development of any software by the Department. The students used the computer as a tool to apply the concepts they had already been introduced to on the course.

4.1.5 : AC 301 Corporate Finance

This optional third year course provides a broad coverage of modern financial management. It aims to give students a grasp of the modern approach to finance and of the recent developments in corporate financing in the UK. The tutorial exercises are designed to give practice in applying theory to problems of practical importance. This year, as a first attempt to introduce computing into the course, a set of data were downloaded from Datastream, the on-line financial database, on to the students' network, and they were asked to perform some calculations, including multiple regression (making use of the Minitab software package), and evaluate the usefulness of the theory to that particular problem.

4.1.6 CS 301 Computer Science and Accounting Assignments

In the third year of their Joint Honours degree course, students are required to do two one term projects which involve the design of a computer system. These have traditionally been run as Computer Science assignments, but recently with the advent of Pcs in the Department, the Accounting and Finance Department has offered assignments. These are of several types:

(i) An information system for the accounting function of a business, e.g. a hotel billing system or a point of sale system;

(ii) The construction of a model that allows them to illustrate different accounting principles, to pursue some research ideas and investigate the application of computing to different aspects of accounting. e.g. Computer Aided Instruction, Expert Systems, etc. It was pointed out to the students that the purpose was to produce courseware that could be used by future students. They usually worked closely with a member of staff who was a specialist in that area. Assignments have included :

Monte Carlo methods for Capital Budgeting;
Management Accounting Database;
Statistical/OR/Financial Management package;
Gilt Modeling templates;
Modeling program for Capital Market Theory;
Sales patterns and working capital model;

Fixed Cost allocation models;
Business Games;
Hospital Crisis Management Game;
Plant Closure Model;
Tax Revenue Generator;
Trial Balance Adjustment;
Patients' Record System using Hypercard;
Expert System for portfolio management;
Expert System for variance analysis;
Analytical Review of a Company.

(iii)Special projects, possibly of their own choosing, which may involve doing a project for a 'customer', trying out new software, designing systems for members of staff, etc.
Assignments in the last two academic years have included:

Re-writing the Medlock Business Game in IBM Pc Basic.
Fixed assets register for a Courtaulds Subsidiary;
Financial reporting system for Pilkingtons;
Property Management system for an estate agent;
Income and Expenditure Recording System for a small business;
Personnel record System for Touche Ross;
Manpower Planning System for Touche Ross;

These assignments offered by the Department (Appendix XIII) permit a much closer integration of the two parts of the degree than was possible before and have really only become feasible with the new technology. The students have had the added advantage of working with a 'customer' and knowing that their work would be used - a highly motivating factor! These assignments have made it possible to investigate and explore the potential of new software tools, design techniques, etc., and thereby build up our expertise about the kinds of materials, the techniques and design issues that may be useful for teaching.

4.2 : Future Developments

Now that these initial developments have been made, there are several other course lecturers who are investigating the uses of computers. A review is being undertaken of the commercial software that aims to teach book keeping for the first year introductory course in financial accounting. There are now several packages, some designed by the Polytechnics, which aim to do this.

The second year compulsory course in Finance is another obvious place to introduce computers, especially as it follows on from the introductory computing course. A review is being undertaken of the textbooks, mostly American, which publish Lotus templates to accompany the text, to see which would be most suitable. It is envisaged that they would be of use for the "what if?" analysis which would enable students to explore the relationships between variables.

As explained earlier, the database for the second year management accounting course is to be developed so that it can be used for the whole of the second

year course and parts of the third year course (to replace the data for the existing Kensington case study).

Lastly, it is expected that more use will be made of the on-line financial database for both the third year finance courses and the financial reporting course. This will involve downloading subsets of data onto the students' network for easy access.

4.3 : Educational Practices

The attempt to integrate computers into the accounting curriculum raised a number of issues in relation to educational practices in Higher Education. It focused attention on teaching methods, course assignments, teaching and examining loads, etc. These issues are relevant, irrespective of the technology employed, but are infrequently discussed in Universities. The introduction of computers, or indeed any other change, however, forces an explicit consideration of these issues.

In relation to the core accounting subjects, the new technology changes the educational methods. It is possible to set larger, more realistic case studies, and to devote most of the class time to discussing the issues that arise, the assumptions, the limitations of the methods, etc., rather than going over the calculations because students can either build their own models or make use of existing ones to perform the calculations.

Technology has also an effect on learning as a social process. Given that larger more realistic case studies can be set and that equipment may be in short supply, the opportunity exists to set group work. Students thereby learn to work in teams rather than individually and competitively. They learn a wider range of social skills than are currently fostered in accounting courses. Group project work requires them to cooperate with each other, divide the tasks, coordinate, lead and discuss with one another. This type of learning situation makes them less dependent on the teacher and more dependent on each other. Most learning is in fact a social process, but the change in technology makes this more obvious.

It is ironic that most textbooks stress that computers make possible an individualised appproach to learning - that the student can learn at his or her own pace. the social aspects are rarely mentioned or appreciated. One of the distinguishing features of computers as opposed to the printed page is that joint/co-operative learning rather than individual/competitive becomes possible and indeed necessary.

However, students do need help in this, to understand the generalisability of their experiences - that they are not unique experiences peculiar to them. It becomes possible thereby to teach them some of the problems involved in project management, e.g. to see why some groups had crises and others did not and what could be done to minimize their effects or to avoid their occurrence altogether.

One of the problems of using computer based exercises is that unless care is taken about how the class assignments are set, only the more motivated

students will do the work. In general, unless the work is part of their end of course assessment, students will not do it or only perfunctorily. It may therefore be necessary to set it as classwork rather than homework.

There are a number of interesting ways that assignments may be used. A series of exercises may be set that make use of the previous results as a building block (as described for AC 305 management accounting). Projects, to be done as team may be set (as described in AC 305 and AC 307). One of the drawbacks of this type of work is that there may not be the time to give students adequate feedback about their work.

One way round this is for all the groups to make copies of their work, which they distribute to their colleagues and the assignment is for them as the senior manager, to review the plans, budgets, etc., of all the groups, including their own. This requires them to assume a different role and to study other people's work and analyse them critically and to see the implications for their work. This type of assignment also avoids the problem of how to assess an individual's contribution to the team. An individual assignment such as this gives each student the chance to participate as part of a team and to make his/her own assessment of the work. Most students said that they learned a lot by studying the way that other people tackled the problem. This method is used in AC 307.

While such assignments incorporate a greater degree of realism and encourage cooperation without fear of plagiarism, a substantial "stock" of such projects are required. They are much more time consuming for both staff and students.

It is important therefore that attention is given across the Department to the question of scheduling the assignments both in relation to the availability of equipment and the students' work load. The integration of computing into the curriculum requires a greater degree of course coordination so that the work set is not to be duplicated and one course can draw on the materials, experiences and skills learned on other courses.

These types of instructional methods and class assignments have an impact on the final course assessment, particularly when this takes the form of an examination. Conventional examinations may not be the most suitable method of assessing the more critical, analytical and social skills that students may have acquired. Other forms of assessment could include:

(1) An oral presentation of their work;

(2) An essay, in examination conditions, based on a case study that has been set prior to the examination. In effect this becomes a prepared essay;

(3) Ask students to review a previous exam paper, and to discuss which were the most difficult questions, etc.

(4) Ask students to prepare a multiple choice question on a book they have read or a particular topic;

(5) Give students a potential exam paper covering the full range of the course, at the end of the course, and tell them that they will have to answer four compulsory questions drawn from this list and the pass mark will be correspondingly higher.

These different forms of course assessment, and there are others, all have pedagogic value in their own right. The issue of course assessment in relation to computer based courseware is one that is of concern to most accounting teachers. Only this project has explicitly addressed these pedagogic issues directly and drew a good response at a recent conference (Shaoul 1988b).

Another aspect of computer technology that should be mentioned is word processing. In Britain, students typically turn in hand written work which is often poorly presented, unprofessional in appearance and difficult to read. Undoubtedly word processing (and the use of graphics) improves the presentation of the work (and reduces staff marking time), but from an educational point of view, there are other advantages that should be considered. Because it is so much easier for students to correct their work or even add to it, the content as well as the form should also improve. It is no longer necessary to leave writing up to the last. It can be done alongside other tasks in the knowledge that it can be easily altered as they are going along. Secondly it becomes easier for students to work and write together. They can make use not only of each other's work but also of other computer legible material stored on disc.

The changes in the instructional methods, assignments and course assessments consequent upon the new technology, also affects the role of the teacher. The teacher becomes less concerned with being the primary conveyer of information to the students, and more a 'resource' or 'facilitator' of learning. But the teacher has to cope with the increased volume of tutorial demand per student. More informal contact is required to resolve difficulties the students necessarily encounter with the hardware and software. Furthermore, this type of teaching places heavy demands on the teacher's time, both in the preparation, supervision and marking.

4.4 : Development of Course Materials

The purpose of this section is to describe the design and development of different types of course material undertaken for this project, their advantages and limitations and to show how our understanding has changed. As has been explained earlier, much of the work that has been developed is being done by third year students - Computer Science and Accounting students - as part of their third year projects course which has already been described (Appendix XIII). While it provides a valuable educational experience for the students, it may also yield courseware for the staff. It has therefore several advantages for the students: they are required to explore in detail an area of accounting; the potential user is a student or teacher; they are working for a 'customer'; and finally their work is going to be used.

Furthermore, most of the work that has been developed will be added to from year to year. For example, the stock recording programs which formed the basis of the students' projects in the second year have themselves resulted in 160,

more sophisticated versions. A few of these will be used in next year's course in several different ways. Students will be asked to review a few of them, thereby learning for themselves what constitutes a user friendly, useful and secure management information system. They will be asked to use one of the more sophisticated systems to record transactions, produce reports on, say sales, and use this information to predict future sales, inventory requirements, cash flow, etc. Next year's project might require them to add several new modules to the system. That is, it will become possible to organize the whole course around different aspects of the system and thereby integrate more closely a course about computing into the curriculum.

The point that is being made is that this work is on going and will be adapted and developed from year to year, according to student needs and capabilities. In fact most case studies are developed in this way. It can be expected that in future years students will come to University with much more familiarity with information technology and that therefore more comprehensive case studies can be used since less time will have to be spent acquiring basic computing skills.

Materials have been, or are currently being, developed that incorporate several approaches (Alessi and Trollip 1985) to computer based instruction:

4.4.1 : Simulation

The essence of this approach to teaching accounting and business with computers, is to give students computer models which simulate economic processes/consequences so that students can select different input values and compare the outcomes. For example, we are using process simulation to calculate the revenue generated from income tax, given different tax rates, tax bands, inflation and unemployment rates. Learning from such a simulation occurs by repeating the process a number of times with different starting values and comparing the results. This was designed to be used on the second year Financial Accounting course AC 201.

With this type of courseware, the solution process is not visible to the student. This is quite deliberate. The calculations are straight forward and very laborious. There is absolutely nothing to be gained educationally from actually performing the calculations. This particular application is completely menu driven. The students are required to input the data and the program checks that the data are internally consistent so that the calculations can be performed correctly. In other words, this approach endeavours to ensure that the users cannot make mistakes. If anything, this particular piece of software has been over programmed in order to make it foolproof. The use of menus forces the student to consciously work through the exercise. No knowledge of Lotus is assumed. In terms of presentation, this type of courseware more closely resembles the conventional problem solving software than the type to be described later - albeit it a simplified form.

But its value, in terms of the learning objectives, is determined by the kinds of exercises that are set by the teacher rather than simply the software. It can be used to set revenue goals and explore the different ways this can be achieved.

Simulations typically have several major advantages over conventional tutorials. Motivation is usually increased since students can see for themselves the consequences of inputting different values, i.e. they are learning by doing it for themselves rather than passively reading about it. Transfer of learning is more likely to take place since simulation gives the students the opportunity to try out different combinations of conditions and thus can be better prepared. The ability to perform rapidly lengthy calculations means that it is possible for students to get a much greater 'feel' for the interrelationships than is possible using manual methods.

Most computer simulations can be used in a number of ways, but their use is only incidental to the simulation. Without the computer software there can still be simulation. With the computer software, the simulation, as the real world, can be faster and more creative.

Another model that has been developed simulates the economic costs to central and local government of a plant closure, given the number to be made redundant, their age, sex, length of service, wage rates, etc. It has no menus or error trapping procedures, making it much more flexible and easier both to develop and to use. But it does require some elementary knowledge of how to use Lotus on the part of the student. Such a model can be used in several ways, depending on the interests of the teacher. One way might be to compare the costs to the community with the benefits to the firm. This would involve giving the students additional data about the firm's cost structure in relation both to the plant that is closing and the one to which production is to be transferred.

Alternatively, it might be set as an exercise to discuss its advantages and disadvantages as a planning aid for central/local government. (It was used in the latter way for AC 200 as already described). The software that is available such as spreadsheets, database management systems, operational research techniques, etc., are usually seen as decision support tools for managers. It is important that if they are to be used in this way that students appreciate the problems raised by the appropriateness of the data. If they are to be taught to become decision makers, they need to be given case material that is wide ranging, not simply numbers to manipulate. Too many exercises in decision making stress detached calculative rationality rather than involvement and intuitive and inferential reasoning (Dreyfus and Dreyfus 1986). Such exercises give the students practice in developing their powers of formal reasoning - a skill not fully developed at their age. The active nature of the task can be an aid to this.

In accounting and business students use, as a learning tool, the very same software that the professional world use for solving the problem, i.e. A spreadsheet model. That is, it is both a decision support tool and a learning aid. In most other disciplines, the teaching aid is not necessarily the same one as they would use in practice.

Simulation models permit different forms of exercises to be set because of their "what if?" capabilities. Such exercises could take the form of negotiations between different interest groups. Furthermore, the scope of such

models and the accompanying supporting materials, often makes it more practical and interesting to assign several students to work together in groups. Thus in addition to changes in performance in the cognitive domain whose objectives emphasise intellectual outcomes such as knowledge, understanding and thinking skills, such exercises also have an impact on the affective domain, emphasising attitudes, responsiveness, appreciation and methods of adjustment.

Such assignments require students to listen to others, be sensitive to the needs of others and accepting of differences. Other objectives include the demonstration of a problem solving attitude, recognition of the role of systematic planning, an understanding of one's own strengths and limitations, co-operation in the group's activities and an objective approach in problem solving. With computer software, the social interaction becomes more necessary and explicit.

Simulations usually require the students to input the data - data whose derivation or significance they may not understand. It is often therefore appropriate to start wih a working model of a given set of interesting data and then ask the students to change one of the inputs. The accompanying material could ask open ended questions such as "What changes did you observe? Why?" etc.

Other models have been developed; some for demonstration purposes in class and some for student use. These include :

The relationship between different sales patterns and working capital requirements (for AC 301 Corporate Finance);

Gilt modeling (for AC 304 Capital Market theory);

Different methods of fixed cost allocation (for AC 202 Management Accounting

Calculation and analysis of standard cost variances (for AC 202 Management Accounting)

An analytical review of a company (for AC 201 Financial Accounting).

Future models to be developed for student use include cash flow accounting, leasing methods, foreign currency transactions, etc.

All these models have been developed using Lotus and only require the student to input the data. The calculations, printout and graphics are produced automatically without any additional action on the part of the student. The aim is to set them exercises that are big enough to warrant a computer and short enough to do quickly. There is otherwise no justification for using a computer as a learning aid. As Seddon (1987) explained, there are opportunity costs involved and an hour spent on a computer exercise can only be justified if it results in greater benefit to the student than an hour spent learning about the concept using another tool or technique.

4.4.2 : Databases

Another major area of importance for integrating computers into the accounting curriculum is the use of databases to bring information concepts and technology into the functional areas of accounting and finance. There are several ways that this is being done.

One such database is a management accounting database consisting of a set of twelve monthly management accounts (i.e. budgeted and actual profit and loss accounts) for one year to enable the management accounting course to be orientated around a real business and the decisions it has to take. It has been possible to obtain the records (sales and production schedules, costings etc.) of a carpet manufacturing company, long since taken over, which has several product lines, cost centres and two operating plants at different locations. The data so obtained enabled the budgeted and actual profit and loss accounts to be calculated. The idea is that students would themselves select and "pull down" the data they need to solve the tutorial exercises from the computer's database. It would have the benefit of realism, convey the inter-relationship of topics and emphasize interpretation and evaluation.

The students would not necessarily use the computer to solve the problem. The issue, as many accounting teachers see it, is that from an educational point of view, the students have to learn to calculate a particular technique manually, without the aid of a computer in the first instance. In any event, in real life, the problem is often one of selecting the appropriate data in the first place. Until now, teachers have had to give students the data. Such an approach means that not only are students learning about different aspects of management accounting, they are also learning how to use information systems and information technology in the context of an accounting course.

Some tutorial exercise are being designed that make use of the database to pull down the relevant data and export it to the relevant spreadsheet template for basic costing and cost classification, marginal costing and cost-volume-profit analysis, budgeting and control, standard costing and variance analysis, fixed overhead costing, pricing, etc. Each tutorial will have a clearly defined format geared to the teaching of the various topics, and once the tutorial is completed, the student will be directed to the Lotus model for analysis, graphing, etc. This is a major resource commitment and it is expected that it will be of interest and use to others.

A similar management information system has also been developed which allows the user to input all the costings, sales and production schedules, etc. and then generates the budgeted and actual profit and loss accounts on a monthly basis. Such a system is of general use for teachers to show the integrated nature of corporate data and would permit them to use data that they had obtained to develop more realistic case studies for students.

The use of financial databases, such as Datastream, is another area that is being developed in many Finance courses. Models can then be developed to analyse subsets of the data. Students should then more readily be able to grasp concepts in finance by using real data in realistic financial models.

Again, the emphasis is on exploring the relationships between variables by making use of existing programs or templates.

The department has been able to get the funds to purchase the appropriate hardware and subscription to a financial database, Datastream. Small subsets of this have been put on a database on the students' network for them to use for their finance courses (AC 301 Corporate Finance). The students use a statistical package such as Minitab to analyse the data.

The database approach is one that lends itself to most courses in the accounting curriculum, for example, the use of financial statement information in evaluating a firm's performance. This would require a database of a number of firms over, say, a twenty year period and software to retrieve the relevant information and analyse the data. Analyses could include: financial ratios, regression and financial projections. Although there is online access to a financial database, the number of students involved on the course means that is administratively simpler to put a small subset of the data on the students' network which they could then pull down and analyse. Again, menu driven spreadsheets have been prepared for the students to carry out an analytical review, complete with graphical output.

Another major related area is the use of information systems, per se, to enable students to access and retrieve data. Furthermore it is necessary to give students experience in using and designing an accounting information system and to see how it relates to other parts of the accounting and management process. Commercial packages can be far too complex for students, in the time available, to fully comprehend. Designing a new system, *ab initio*, is likewise too difficult and time consuming. It was therefore decided to set coursework which involved giving the students a listing of four separate programs which together make up the elements of a very rudimentary inventory recording system so that they can see the basic elements of an information recording and retrieval system.

The first program allows the user to change various fields of a record in the inventory database by means of a menu, thereby adding, deleting or editing records. Only the standing information can be altered in this program. This is to illustrate the concept of segregation of duties for control purposes.

The second program allows the user to ship or receive goods, thereby updating the quantity on hand. Other fields, such as the data of the last transaction, value of the inventory, sales to date, are updated automatically. However, the version given to the students does not show on the screen, the record that has been selected for updating, nor does it show the record after it has been updated, as does the database maintenance program. Thus it is possible to inadvertently select the wrong record. Furthermore, there is no information about the stock levels, etc.

The third program lists all those records in the database where either the reorder point or reorder level is greater than zero. The database itself contains one hundred records, many of which are empty records. The report program flags all those parts whose quantity on hand has fallen below the reorder level, counts the number of valid records and the total number of

records processed. The latter figure is incorrect.

The final program, the audit trail, records all the changes made via the transaction menu, although not the amendments menu. Here, what is being illustrated is the necessity for preserving the original information for control and security purposes. It lists the part number, a code for the transaction type (1 for parts shipped and 2 for parts received) and the size of the transaction.

The students were required to alter the existing system: to make it more user friendly by merging the programs, using a menu, including more helpful screen messages and improving the usefulness of the reports and also to improve the security of the system by introducing password control, data validation checks and more details in the audit trail that logged the changes made to the stock levels. The incorporation of an audit trail is a major, but simple, feature of this system and one that is very relevant to an accountant.

The use of informations systems as courseware familiarizes the students with the problems involved in data security, information retrieval, etc. They can see for themselves the possible sources of error, social and organisational problems in using computers. It is intended ultimately to include a financial reporting system into the curriculum.

The use of databases and information systems are in fact the major areas that are being developed, as they appear to offer the most potential for effective computer use in this area of Higher Education and mirror the ways that computers are being used in the world at large.

4.4.3 : Instructional Games

These are a powerful learning tool that are becoming more prevalent. Like simulation, their purpose is to provide an environment that facilitates learning or the acquisition of skills. They often simulate reality and usually provide an entertaining way of practicing different accounting and management techniques, e.g. production planning or inventory control.

From a design point of view, these may not be very different from a simulation (cf. the negotiation process above), although this will of course depend upon the objectives of the instructional game. Elgood (1988) gives a full discussion of the design and educational issues involved. Like simulation techniques, the objectives of such games emphasizes the cognitive and affective domain.

One such game has been developed whose objective it is to aid students to understand the economic significance of current affairs and news items and to assess their impact on the financial markets. The object of the game is to maximize the return from the portfolio of assets (inherited from a rich uncle and currently valued at $10,000), by analyzing a financial journal. Each news item may have some economic consequence affecting asset prices. The fund is to be actively traded to obtain the most benefit from favourable adjustments and equally to avoid costs incurred in unfavourable situations.

The software was designed using the programming language BASIC for portability so that the teacher may add in news items as they become topical, etc. However it would have been quicker and more appropriate to have developed it using dBase and run it as a compiled program.

Games such as this can be used in a number of ways. It was designed so that students would work in groups, competitively against other groups. As such it could be used as an 'ice-breaker' in a tutorial at the beginning of a course.

A hospital management game has been developed to test the user's power of analysis against a model that incorporates both the financial and non-financial consequences of decision making. It produces a 're-iterative' model so that the user can learn or develop his/her skills based on evaluated feedback on his past decisions.

The game centres around a possible dispute over night catering facilities for accident and emergency staff at a local hospital. Financial data on the various courses of action are provided. The user is asked to consider the possible courses of action together with the various manpower problems that they may cause and to choose his/her preferred option. The option is also given to select from a menu, how to deal with the immediate problems of the various factions of staff (porters, surgeons and nurses). Data on staffing levels and bed occupancies for previous years are provided, together with wage levels and future staff budgets. The user has to devise a staffing strategy for the next few years based on this data and also other information provided as to how the accident and emergency workload is expected to increase over the next few years. The software produces the accounts for the year end, based on the decisions made.

As in all the courseware described so far, the user needs only a rudimentary knowledge of computers and spreadsheets. This model was developed in the Department of Accounting and Finance for a graduate post-experience course for hospital administrators and is based on a real crisis at a local hospital a few years ago. The case itself has been successfully used used as a training exercise for some time, but lends itself to computerization for ease of use. A number of approaches have already been made to the author to computerize case studies which are too unwieldly/lengthy to be used in undergraduate classes. It seems likely, given the time taken to develop the software that it is better in the first instance to computerize case studies that are known to be educationally effective.

4.4.4 : CBT/CAL/CAI

It was not the intention to spend much time developing Computer Based Teaching packages (CBT), variously known as Computer Aided Instruction (CAI) and Computer Assisted Learning (CAL) as the use of such methods of teaching accounting was not seen as particularly suitable in the context of UK Universities and the less (compared to the US) vocational orientation of accounting courses (Shaoul 1988a). However, authoring systems are now widely available for the design of tutorials and drill and practice sets and it seemed useful to explore their advantages and disadvantages.
Furthermore, it was thought that it could be useful to have such sets

available for students who wished to use them for remedial instruction and additional practice.

A trial balance adjustment package was designed using an authoring system. It could be of use for courses AC 150 and AC 201. While it appeared to be a very simple and effective package, it was not at all clear at that time, similar instructional packages could not more advantageously be created with Lotus. This approach was therefore abandoned. However the macros in Lotus 2 are far too cumbersome to be used for more than six lines of code and subsequently this approach was also abandoned.

4.4.5 : Expert Systems

Expert systems have been widely heralded as an important tool for managers. One expert system, to calculate the standard cost variances and to select which of the many variances warrant further investigation, has been built (Shaoul and Smith 1988c). The purpose was to illustrate to students their uses and limitations as decision making tools. Other expert systems have been built for portfolio management. It is intended to build other such systems for students to use and appraise.

But expert systems have another application in the field of education (Shaoul 1988d). They are useful as a training device, that is to give managers, new to a task, repeated practice. Particularly useful features of expert systems shells are the ability to rerun the system using slightly different inputs and secondly the ability to explain how the conclusion was reached. Furthermore, building such a system is a valuable way in its own right of learning the nature of the task as well as the determinants of expertise.

4.4.6 : Courseware to Demonstrate Concepts

The purpose of this section is to describe the development and design of courseware which can be used by the teacher to demonstrate concepts and by the student to acquire the conceptual knowledge. It is important to stress that the development of good courseware does not simply involve the preparation of computer based materials but also includes reworking the way the exercises are set. Since the time taken to perform the calculations is very short, the numerical part (as opposed to the discussive part) of the exercises can emphasize the relationships between variables by requiring recalculations with different values, as well as the technique itself.

However, a full discussion on the issues involved in the design of supporting materials to accompany computer based courseware is beyond the scope of this report. An analysis of the differences in the kinds of exercises which can or have been set for computer based and non computer based courseware in terms of the type and extent of the coverage of the topic would be useful in assessing the effectiveness of the use of computers in teaching accounting and the way it affects the teaching process, but likewise is beyond the scope of this report.

This type of courseware is probably of most use in the introductory and intermediate accounting courses which are primarily concerned to impart a wide

range of techniques. Teaching at this level usually involves isolating a particular topic, explaining it to the students, giving them exercises to do and feedback as to their performance.

General instructional objectives (Gronlund 1985) will include **knowledge** of the common terms, methods and procedures, basic concepts and principles. Students will be expected to **understand** these facts and principles, interpret the verbal material, charts and graphs, translate the verbal material into mathematical formulas, estimate the future consequences which are implied by the data and justify the methods and procedures. In addition, students are expected to **apply** the concepts and principles to new situations, solve mathematical problems, construct charts and graphs as appropriate and demonstrate the correct usage of the method or procedure. They also need to be able to **analyse** the material, that is to recognise the unstated assumptions and logical fallacies in reasoning, distinguish between facts and inferences, and evaluate the relevance of the data. At a higher level, they need to be able to integrate learning from different areas into a plan for solving a problem (**synthesis**) and **evaluate** the methods and procedures for a given purpose.

The type of courseware that is described in this section is likely to be of most use for the lower levels of cognitive skills, i.e. knowledge, comprehension, application and analysis rather than the higher level skills of synthesis and evaluation. But to a large extent this will depend on the nature of the exercises set, rather than on the computer courseware per se. The point is that novices learn a new task as a series of rules and have to practice the task consciously in as many of its different forms as possible until they have gained enough experience to be able to match the real life situation to the technique automatically. Well designed computer courseware should enable the students to practice the task repeatedly and relatively quickly.

4.4.6.1 : The characteristics of courseware to demonstrate concepts

Most spreadsheet templates which are generated by the user from commercial software to solve problems are of little use for pedagogical purposes since they aim to present the finished solution. All the intermediate steps required are not clearly evident in the solution process, thereby encouraging the student, as many teachers have noted, to passively accept the finished solution.

A spreadsheet presentation requires the teacher to plan carefully the sequence and logic of the solution process, i.e. when and how to develop formulas and calculations. In addition consideration must be given to the theoretical stumbling blocks, calculations, formulas and sensitivity analysis. It has to reflect the thinking process of the user and the individual style of the teacher. It should promote active student involvement in the solution process by requiring the student to check the reasonableness of the answer and encourage students to ask related questions. Thus courseware is quite different conceptually from a template designed to solve a problem.

If prepared in this way, the spreadsheet combines the sequential solution power of the overhead projector with the ability to present several different

solutions depending on the choice of inputs. To achieve this kind of flexibility without using a computer often requires at least two overhead projectors.

Such a presentation requires the use of a portable computer and projection facilities which are expensive. (The cheapest is the Sharp at approximately #800.) Furthermore the equipment does take a few minutes to set up and dismantle which can be a problem when classes are taught in different locations. It is probably easier to have on a dedicated set of equipment permanently set up on a trolley.

While such courseware is considerably easier to develop than say a tutorial package using an authoring system, it does take some time. While it may be possible for teachers to share courseware, differences in individual teaching styles usually preclude this. There may also be difficulties in the same teacher using the same spreadsheet solution for similar courses. The inflexibility inherent in the prepared solution generally requires the same presentation of the topic, which may limit its usefulness for certain topics.

The development of the design process is illustrated with the use of compound interest problems as examples, although the principles are valid across many topics.

1. Select a Topic.

Alessi and Trollip (1985) suggest that not all topics are in fact suitable for such treatment. They list and discuss the characteristics of relevant topics which are likely to include all or some of the following: subject matter that is difficult to teach in other ways, has conceptual importance, requires a significant number of calculations, involves a solution algorithm, repeated "what if" analysis to bring out the relationships between the parameters and graphical or some form of visual presentation.

The time value of money is a major topic taught in accounting courses. It fulfills the above requirements by requiring a large number of routine calculations and the repeated use of a few formula. The solution process is easily identified and an understanding of the process is gained by applying the concepts to a number of problems and changing the variables.

2. List the important concepts associated with the topic.

Some of these would include : identification of the variables, the relationship between the compounding assumption, the payment and the number of periods, the inverse relationship between future value and present value, the difference between a single payment and a number of payments and an annuity, the difference between the number of periods and the number of payments and the difference between an ordinary annuity and an annuity due.

3. Develop a list of learning objectives (Gronlund 1985).

This is absolutely crucial because it both guides courseware development and provides the means by which the courseware can be evaluated and improved. In

relation to compound interest, a student could be expected to :

a) Identify the variables in the formulas;

b) Correctly identify the appropriate formula needed to solve the various types of compound interest problems in Financial and/or Management Accounting;

c) Understand and predict the effect of altering one or more of the variables;

d) Assess the reasonableness of the answers obtained;

e) Make necessary adjustments to the variables to accommodate different compounding assumptions;

f) Explain the relationship between future value and present value.

4. Outline the Solution Process.

This aspect can be difficult since the instructor is so familiar with the topic that many of the steps are taken for granted. Furthermore certain steps have to be stressed to students encountering the problem for the first few times. This is where the teacher's experience is so crucial, in knowing where the student is likely to have problems. The steps involved in solving a problem might include :

a) Does it involve future or present value?

b) Does it require one or more than one payment?

c) Identify the given variables and the unknown variables;

d) Specify the compounding assumption;

e) Calculate the answer;

f) Assess the reasonableness of the answer;

g) Change the variables for sensitivity analysis (if appropriate).

5. Select representative problems and exercises.

Obviously it is important to include at least one basic exercise and one complex example. This is very straightforward in the example given since all the textbooks give plenty of exercises.

There are of course a whole number of aspects to the question of the time value of money, other than the computational aspects. Conceptual questions would normally be included with each exercise because they, not the computation, should be the primary focus of an exercise. Indeed, students

should be encouraged to read the conceptual questions before beginning the computational exercises so that they can consider them during the exercises. Sometimes the answers will be found in the text book or will have been discussed in the lecture, but sometimes the questions will raise issues that have not been explicitly discussed.

Since computers are being used as an aid to learning and because they will be using computers so frequently in their working lives, students should be encouraged to become as conscious as possible about the computing issues, e.g. the design of the spreadsheet, instructions, output layout, etc. Questions can be included for the students to think about during the working of the exercise and to answer after completing the exercise. For example, they can be asked about the measures that can be taken to check the accuracy of the templates and whether in the process of so doing, they found them easy or difficult to verify, and why.

4.4.6.2 : Courseware design

There are a number of design issues that need to be considered: data input, the calculation and formulas, the results and "what if" analysis.

Data input

The instructor must decide whether to use an input screen to handle all the data or to collect the inputs from the user in the context of the solution screens. While the separation of data input from processing is more efficient and enables the user to alter the inputs more easily, this may not be the most appropriate design from the perspective of the learning process. There are occasions when the logic of the task requires data to be input at different stages of the calculation process. The nature of the application will determine the best approach. In the case of the compound interest example, since the variables are relatively few in number, it is possible to input the data on the same screen as the solution process.

Calculations and formulas

The next decision is whether to include the formula and the calculations in the courseware. While it is desirable that the students be as active as possible in the solution process, in an example such as this where the calculations are very repetitive, or where the students would select and use the appropriate look up table to obtain the answer, or where the formulas have already been explained, or where they are very difficult and lengthy to incorporate correctly into the cell, then it may be more appropriate to include the formula and the calculations.

Solution process

The step by step solution process used when solving the problem manually must be preserved and transparent to the user. Such techniques commonly include :

a) Asking and answering a series of questions;

b) Using a series of menus to walk through the decision process and direct the user to the various parts of the solution;

c) Using a series of successive screens (groups of 20 rows of cells) to present the solution.

But whatever the method, the students should gain an understanding of and reasons for the solution order. One method of presenting compound interest is to develop a series of templates to solve the various types of problems with menus for the student to select the appropriate template for the problem. The selection of the appropriate menu, by emphasizing and mirroring the solution decisions, is an important part of the learning process and provides an an excellent opportunity to discuss the differences between the different methods, etc.

It is here that the difference between an efficient program or template to solve a problem and courseware becomes apparent. Templates are designed to achieve the correct answer with the minimum number of user inputs. The data inputs would be checked for completeness and internal consistency, etc., to prevent the occurrence of any errors. But courseware should give the student the chance to make the common mistakes associated with compound interest problems and to correct those mistakes after discovering that the solution is unreasonable, e.g. the mistakes associated with quarterly and semi-annual compounding. Hence the courseware requires the student to enter rather more data than would be required by a spreadsheet to solve the problem in the quickest possible way.

Providing solutions and/or explanations

Depending on the application, it may be appropriate to show a worked example, or give an explanation of the solution, its derivation etc. This can be done by including this on a separate screen for the student to compare the answers.

"What if?" analysis

Having gone through the basic problem, the teacher can then do a "what if" analysis. If it has been worked as an ordinary annuity, it can quickly be reworked as an annuity due, which enables the student to see the impact of the time value of money. Next the interest rate can be changed to demonstrate the importance of the rate assumption about reinvestments in the decision process. Students could be asked to explain why the present value of payments at 6% is higher than payments at 8%. Next they can be asked to change the compounding assumption, which also requires them to change the payment amount, the periodic interest rate and the number of payments. Finally they can be asked to reconfigure the solution using future values, which requires them to compute the future values of the single payment and the series of 20 payments using the future value templates, thereby exploring the relationship between present value and future value.

Graphical presentation of the alternative results.

Depending upon the particular application, it may be appropriate to present

the alternative results in the form of a graph. This could be incorporated into the main menu. The use of graphs brings out more clearly the difference between different methods of calculating a problem, assumptions and starting values etc.

4.4.6.3 : Evaluating the courseware

After selecting the exercises and problems and constructing the courseware, it is essential to determine whether the material achieved the coverage of the concepts and objectives specified earlier in the development process. All have been covered by the variety of exercises and courseware, except for identifying the formulas for NPV and FV. In the example the formulas were given for the reasons which were stated earlier. The students still have to identify the correct formula by selecting the appropriate menu.

If the construction of the formula is deemed to be important, the formulas could be entered in the remote cells, off screen, and the students could be requested to develop it in the solution process. (The advantage of having the correct formula off the screen is that it permits the correct answer to be calculated and the student's answer to be evaluated, commented upon from within the template.)

Additional questions measure the effectiveness and suitability of the courseware :

a) Does it provide for the solution of several different typical problems and exercises?

b) Does it allow for the changes in the assumptions and facts?

c) Can the students see the entire solution process?

d) Are the students actively involved in the solution process?

e) Does the application lead to conceptual questions?

f) Does it cover the topic more efficiently than traditional methods?

g) Does the application lead to questions about computer practice issues?

A review of the courseware indicates that the concepts and objectives have been covered. It takes less time to present the concepts in class than using the OHP. Most of the time can be spent asking and answering conceptual questions rather than performing routine calculations. Most important of all the students have been involved in the step by step, visible solution process.

From the perspective of students using courseware such as this to acquire the knowledge of the topic area, there are a number of issues raised by this approach. From observations of students' performance in class, where typically exercises are set that require them to do some calculations and then to discuss the issues raised, it appears that they usually attempt the

calculations, but if they have had difficulty with the calculations or get them wrong, they are unable (or unwilling to spend the time) to sort it out for themselves before they get to class. Frequently, then, the class time will be used discussing the routine calculations rather than the conceptual issues.

Courseware such as this permits the student to rework the exercises as often as they like and to see for themselves whether they have got it right and to go on until they do get it right. Thus they can come to class knowing how to do it and perhaps even more importantly, having done a sufficient number of exercises to have acquired some understanding of the issues so that they can discuss them in class.

The point is that interactive courseware of this sort provides the student with some feedback as to his/her performance, whereas conventional homework does not. This encourages them to persevere until they have completed the work satisfactorily. It is less easy to give up before having mastered the topic. The nature of many exercises that are set (no formal rewards, individual assignments, no obvious "closure" point, etc.) is such that it requires an unusual amount of perseverance to complete it to the satisfaction of the teacher, even though the absolute amount of time may actually be quite short and the exercises themselves are quite interesting, once the students 'get into' them.

4.5 : Conclusion

This chapter has attempted to describe the many different ways that computers can be used effectively within the accounting curriculum. It is not simply a question of investigating what we can do with a computer but rather what we are having difficult with teaching at the moment in an effective way. It has described the features of software to be used in a pedagogic environment which differ from those used in the business world, even though the software tools themselves may be identical. Emphasis has been placed on the fact that additional supporting materials and new exercises will need to be designed to go with the computer courseware, and that it is these factors that will be crucial in determining the educational effectiveness of using computers as a teaching/learning tool.

The examples that have been given have been used to illustrate the generic type, the characteristics of the software and the exercises, in order to draw out the design issues and educational implications of using computers. Our conceptions of how they can be used have changed as collectively the academic community at large, not just accounting teachers, have gained experience in their use. There is greater attention being paid to the use of simulation, databases, computer based case studies where the emphasis is on the inter-relationships between variables, as opposed to the early enthusiasm for self teaching tutorial packages, drill and practice sets. Even in these areas, our conceptions of how these may be designed for increased effectiveness has developed and new tools are becoming available, such as Hypercard, (for the Macintosh), which will make self-teaching packages more useful and interesting.

Not only has our understanding of the objectives and design principles of

computer based courseware changed, but also our knowledge of the most efficient software tools. For example the portfolio management game was developed and written using the BASIC programming language. It would have been very much quicker to have used a database language. Similarly, the tax revenue generator was coded in Lotus, but could have been done much more efficiently, from the developer's point of view, using dBase.

Furthermore it became clear that the production of good courseware is a team question. it requires inputs from the teacher in the discipline area, the programmer/designer with support from Computer Science displines, people with expertise in the man/machine interface, i.e human factors, as well as from the ultimate user, the student. The better courseware had been widely tested. The expenditure, in terms of time of all concerned was a non-trivial item, even when the software tools were well-known. Thus our original aim, to produce computer based case studies in a relatively short time, was idealistic, to say the least.

While several illustrations have been given about the ways that computers can be used as a learning aid, it should be borne in mind that computers are only one of a wide range of the newer technological tools that have educational value. It is not intended, nor would it be desirable, for the conclusion to be drawn that all aspects of the accounting curriculum should include the use of computers.

As with any educational resource, to make effective use of commercial software to develop courseware, teachers must be attentive to the pedagogical concepts involved in the learning process and create an active rather than passive student role in the solution process.

Attention has been drawn to the ways that computers can be used in teaching the core accounting subjects. It is noticeable however that many of the most innovative uses of computers are actually in subjects such as marketing, management and economics, courses which are usually optional or subsidiary courses, although there is some degree of overlap. There are therefore a number of potential sources of educational computing expertise.

The point was made earlier that there are three distinct reasons for introducing computers into the accounting curriculum - for students to be able to make effective and efficient use of computers when the need arises, for students to be able to understand how accounting information systems work and how they may be used and finally for students to have access to another educational tool, in the same way that they have access to books and journals, as an educational resource. An approach such as this is attempting to provide a cohesive framework for introducing and integrating computers into the accounting curriculum.

The emphasis has been on developing course materials that make use of software and databases to learn the principles of accounting and business and/or as a problem solving tool, rather than simply learning the software as such. In terms of the objectives of the project we can say that not only have we attempted to integrate computers into the accounting curriculum, designed different types courseware to permit this, we have also looked at the design

issues and educational practices that follow from using computers in teaching. These are outlined in various publications relating to the project (Appendices XVI and XVII).

Chapter 5 : Dissemination

This chapter attempts to deal with the second objective of the project - namely that the case studies developed should be made available to other University teachers, both those who are experienced users and those embarking on this path, so that ity should not be necessary for them to start at "Square One" again as we did. As was explained at the outset, not only was there a dearth of really useful resources, there was also no mechanism for sharing courseware and experiences.

The question that now arises is how best to disseminate this work. It is pertinent therefore to consider the kinds of materials that are available, the purpose for which they might be used, some of the reasons why accounting teachers might want to share computer based teaching materials, both from the perspective of the author(s) and the prospective borrowers, the requirements of both parties and how this might be achieved.

5.1 : What Can Be Shared?

The term "accounting courseware" covers a wide variety of materials that can be stored on a computer disc and used for educational purposes. Courseware includes not only the computer readable material but also the accompanying documentation that includes the student exercises, instructions for use, program or template specification, teacher's notes and other supporting materials.

Considering only the computer readable material, there are many different forms of courseware:-

(1) Models/Simulations
(2) Instructional Games
(3) Computer assisted learning packages
(4) Expert Systems
(5) Programs, including commercial accounting packages
(6) Templates
(7) Databases
(8) Drill and Practice sets

Each of these different types of courseware have different instructional objectives and therefore different uses. For example, courseware to demonstrate concepts and help the students acquire conceptual knowledge will chiefly be of use in the first and second year courses, while simulations may be used to explore relationships between variables and may be used at all stages in the course. The purpose of instructional games is to provide an environment that facilitates the acquisition of technical and social skills. They usually simulate reality and provide an entertaining way of practicing different accounting and management techniques. Databases may be used to bring information concepts and technology into the functional areas of accounting and finance. Similarly, the programs and data files that constitute a management information system can be used to illustrate the integrated nature of corporate data and the use of such data generated by routine transaction

processing for planning and control.

These various forms generally however resolve themselves into four main types of media:-

(1) Programs
These may use many different programming languages, e.g. BASIC, Pascal, Cobol, Fortran , dBase III+, etc. This category also includes the authoring languages and delivery systems for computer aided instruction, expert systems.

(2) Databases
These will require different enquiry languages,
e.g. dBase III+, Paradox, etc.

(3) Spreadsheet templates
These will require different spreadsheets, e.g. Lotus, Supercalc, Multiplan, etc.

(4) Data files (including text files) that can be exported to programs, spreadsheets, word processing packages, database management systems or statistical packages.

5.2 : Why Share?

Before considering the kinds of information and materials that could usefully be shared and therefore included in any directory of courseware, it is pertinent to consider the reasons why accounting teachers might want to let others make use of courseware they have developed and in what way other teachers might want to make use of it, how the motives of the two parties match up and what this implies for the development of such a directory.

The prospective borrower wants to save money, by not having to purchase courseware at commercial rates and time, by not having to develop materials that are very time consuming to develop, even if one has the expertise to do so. Simply being able to program is not sufficient to produce educational sound, well designed and error free software as any commercial software house will tell you. Furthermore, most of us do not have the expertise to develop it ourselves as the plethora of poor educational software produced by teachers rather than software specialists testifies, as Self (1985) in his critical review of educational software has explained. Even if we do, why re-invent the wheel?

Ideally, the borrower wants accounting courseware that can be copied straight onto the hard disc of a Pc, or a single floppy disc, that is easy to use and self explanatory and comes complete with exercises, for a nominal handling charge, preferably free with no copyright restrictions etc., ready for student use! However, in practice it is extremely rare that one can make use of other people's software, even though it may be reasonably user friendly, without investing a considerable amount of time in ascertaining its educational implications and value and the logistical problems entailed in using it with a large number of students.

However, student use of the software is only one of the potential reasons why a teacher might want to use other people's software in the teaching context. Some software might be of use for the teacher to demonstrate a particular concept to the class rather than for student use.

Both of these two instances stress the actual use of the software per se. But increasingly, people take copies of other people's work to copy and develop their ideas for use in their own particular environment. Rarely does the software do exactly what you want or in the way that you want it. It might be the concept that is of interest or a design feature. In other words, people may also share software because it is "interesting" and in order to keep up to date with current developments, in much the same way as one buys a book. Some teachers may want to build up a collection of computer based case studies or models for students to compare and evaluate from a variety of different perspectives. Indeed, it is clear from attending conferences and discussions with other teachers that there is very little sharing as such. Rather it is the ideas that are of interest to others.

Thus there are at least two quite different kinds of requirements for software on the part of the borrower that have implications for the way that they may be disseminated. Both have the same requirement for user friendly, error free software, etc. But the latter type of user is likely to be content with less documentation in relation to the student exercises and may satisfied with obtaining the software while it is still in its formative stages.

However the authors' reasons for publishing and making their software widely available do not necessarily coincide with those of the potential borrowers. Most accounting teachers are probably willing to share their software if they cannot get it published on a commercial basis (and the assumption is for the purpose of this report that most such software is not commercially viable). Many are satisfied that something they have developed can be used by others. Others may wish to publish in order to stimulate discussion and further the development of the work and if it will count for promotion/tenure purposes.

While many teachers may be willing to disseminate their teaching materials, most will be unwilling to do so if it requires a great deal of further effort to produce good documentation, additional testing, revision and evaluation. While the prospect of that may be formidable enough, the most daunting aspect of publishing software is the inevitable maintenance and queries from users.

Furthermore, within the present reward system, there is little incentive to release teaching materials that have taken a lot of time to develop without obtaining some "credit" or "brownie points" for it. Until very recently, there was no forum, such as academic conferences, for presenting accounting courseware and getting some discussion of the issues involved. This in fact was the reason for holding such a conference as "Sharing Accounting Software" at Manchester University in March 1989 and also for asking the British Accounting Association to hold a workshop on this subject in March 1989.

It is also difficult to get courseware published in refereed academic journals. To a large extent, this is because most journals are devoted to

research rather than teaching. Publication of courseware is therefore likely to entail starting a new journal explicitly for such a purpose - a hazardous venture - or getting journals to devote a special issue, say once a year, to accounting courseware in their area. But in any event, it is not clear that academic journals are a very suitable medium for describing accounting courseware. Another option is for journals to publish software reviews in the same way as they publish book reviews. The author of this report has been asked to join the Editorial Board of the British Accounting Review which is well known for its excellent book reviews to organize this. What requires to be developed are suitable forms of case study compilations/journals/reviews etc. and conferences/workshops/Open Days where software can be demonstrated. The latter are particularly important since most software benefits from being explained in a social setting rather than simply being tested out in the solitude of one's office.

5.3 : Caveat Emptor

There are a number of issues that any prospective user of accounting courseware will need to be aware of:

a) Hardware/Software requirements

Clearly, the prospective user needs to know what the minimum hardware requirements are to run the software satisfactorily. Are on-line printers required? Graphics or colour screens? Can the courseware be loaded onto a hard disc and run without the use of floppy discs? Does the student need his/her own disc to store data? Similarly, what languages are required? Can a site licence be obtained and copyright permission for duplicating the supporting materials? What is the cost of obtaining a site licence/copyright? Will the user receive updates? Can the user customize it for his/her own requirements? Are the supporting materials voluminous?

b) Educational Practices

The prospective user needs to know what academic course and at what level the software is aimed. What conceptual knowledge on the part of the student is assumed? What computing skills are required? How long, approximately, will it take the student to do? This information is necessary for planning the computing resources that are required as well as providing the teacher and student with some idea as to how much time to set aside for the task.

The teacher needs to have some guidance as to how to integrate the software with what is currently taught on the course. Is, for example, the courseware sufficiently self-contained and user friendly for the work to be set as homework, e.g. a template that compares three different methods of fixed cost allocation, without any supervised instruction by the teacher? Is the work supposed to be done in class so that the work can be discussed as it progresses, e.g. an instructional game? Is it to be set as a group exercise? Does it supplement a well known text book or approach? Are other readings and supporting materials available? How voluminous are the supporting materials? What kinds of questions can be set? What kinds of difficulties do students commonly encounter with the software? With the exercise? What expertise is

required on the part of the teacher? How does it affect the organisation of the rest of the course, the course assignments and finally the course assessment?

Information on all these points will enormously aid the teacher in using the software in the best way possible. Furthermore, the availability of such information indicates that the authors have used the courseware themselves quite extensively and have thought about these issues. Nothing would be more off putting to a teacher who is a computer novice as far as using computers in teaching is concerned, than to use someone else's software and find that it has disruptive implications for the organisation of the course that had not been foreseen. The use of computers in courses which do not currently use computers is likely to have a most disruptive impact.

In other words, in the absence of such information, the borrower may have to spend a considerable amount of time testing out the software in order to see what the implications, both educational and organisational, are. **Thus, the borrower would need to be a fairly sophisticated computer user in order to evaluate the courseware**. Yet the purpose of sharing software in this way is to encourage teachers who do not have not have a great deal of expertise in computing to use computers where appropriate as an educational aid.

c) Evaluation and Testing Strategy

Any prospective user needs to know to what extent the courseware has been tested and evaluated. Courseware needs to be tested thoroughly to ensure that it operates properly and that it deals with the subject matter in an academically sound way. This includes checking the supporting documentation and user instructions. Secondly it needs to be tested with small groups of students to get their response and ascertain which parts of the software are not clear, etc., with a view to revising it before it is used with a large group of students. Thirdly an assessment needs to be made as to how well it operates with a large number of students, e.g. is the computer's response time too slow with a large group using it simultaneously.

Finally, it essential to assess how well it accomplishes its instructional objectives. (As pointed out earlier, there are opportunity costs involved.) Alessi and Trollip (1985) suggest a schema for reviewing educational software. While it is easy to state the necessity for such an evaluation to be carried out, it is less easy to specify objective performance indicators of educational effectiveness that are in fact practicable to measure. While it is possible in principle to compare examination results from year to year in order to ascertain whether performance has improved, it is very difficult from such empirical studies to assess the causes of any such differences (statistically significant or otherwise) that are observed. Since the content of examinations vary from year to year and in effect examination marks are normalised, comparison of examination results on an annual basis may not be a useful measure of the degree to which computer based instruction has achieved its objective. Thus such measures as can be used are likely to be very subjective and in practice the issue of evaluation resolves itself into the extent to which the courseware is acceptable to both students and staff.

5.4 : Courseware Developed at Manchester University

Appendix XIV lists the courseware developed and Appendix XV describes in some detail the kinds of courseware that have been developed as a result of the CTI project in the Department of Accounting and Finance at Manchester University. It gives a brief description of each, the form of the computer software, the hardware requirements, knowledge of computing assumed on the part of the student, the course for which it might be suitable, etc. The purpose was to explain the range of courseware that has been produced, but it becomes very clear that it is very difficult to convey succinctly all the kinds of information that a potential user might require in a report such as this.

In relation to the courseware that has been developed within the Department of Accounting and Finance, it can be said that in general the newer applications have in fact proved popular with the students and much more popular than programming. Most of the students stated that they enjoyed using spreadsheets, although they would have benefited from more instruction in them. To a large extent, their perceptions of the value of the courseware are influenced by the fact that they know that employers are increasingly requiring skills in IT. Many of the students appreciated the different types of educational practises and exercises that were set as a result of using computer based courseware.

In relation to the degree of acceptability of such courseware to the staff concerned, apart from such courseware that is readily seen to be unsuitable for whatever reason, the major cause for concern is usually the staff time involved in the administration of the changes involved in running such courses and the fact that such courses are usually very labour intensive, rather than the educational content of the courseware per se.

Given that most of the material has been developed as a result of this CTI project and therefore much of it has not been used by more than one group of students, it cannot be said to have been adequately tested or amended. Nor can its value as an educational aid be assessed in such a short time span.

5.5 : Methods of Dissemination

While it is certainly true that to release software without adequate testing, evaluation, documentation and guidance for other teachers may be to create more problems than it solves, it is also true that there is indeed a great interest in and an enormous requirement for good computer based case studies which are very time consuming to produce. Therefore to wait till the software has been thoroughly tested may mean that other University teachers will have to re-invent the wheel, which is what research projects of this sort were designed to prevent. It may be that to release the case studies, albeit in a less than polished version, may provide the impetus for other teachers to develop their own and to aid in the development of these case studies.

The development of case studies is in fact a continuing and a social process. These issues can only be resolved by discussion with other teachers. A series of workshops/seminars have been held/are to be held to raise these issues and to invite suggestions while at the same time encouraging people to try out the software for themselves.

5.5.1 : Departmental Seminar

A research seminar was held in the Department to address the issues involved in integrating computers into the curriculum. It is intended to hold workshops for members of staff in the Department to show them what has been developed, in particular the management accounting database and the ways it can be used for teaching, to encourage them to 'commission' further work.

Other members of the Faculty of Economic and Social Studies will be invited as some of the material taught on their courses overlap with this Department's. In fact, one of the case studies, the hospital crisis management game, was developed in collaboration with another department which teaches graduate courses on hospital management. Two models were developed for teachers in the Department of Economics. The issue of coordinating computer based instruction across the Faculty is becoming an important one as departments that have never in the past used computers are now wanting to do so.

5.5.2 : Staff/Teaching Workshop

The Staff/Teaching Workshop has also been used as a forum to give a paper to explain and get some discussion of the issues involved and to encourage people to use the software. There are several other departments in the University that teach similar material.

Electronic spreadsheets, primarily developed for commercial use, are now beginning to be widely used in education, not just in accounting courses. Science teachers are using them for recording laboratory data and analysing it. In building, spreadsheets are being used for recalculating the bill of quantities, consequent upon a change in design or materials etc. In planning, spreadsheets are used for population projections. In any event, many of the issues raised are very general and go far beyond the boundaries of one department.

5.5.3 : Sharing Accounting Courseware Conference

In order to inform other academic institutions about the results of the CTI project, a conference was held at Manchester University in March 1989. The conference provided a forum for lecturers to discuss the issues involved in using computers for teaching and to hear about and try out for themselves courseware that had been developed elsewhere. The conference consisted of parallel sessions of papers relating to courseware, demonstrations using overhead projection facilities, of courseware that was being used, as well as informal presentations during the lunch break of participants' own courseware.

More than one hundred people participated, from all over the UK, including University, Polytechnic, further education and business school lecturers as well as representatives from the accountancy bodies. The call for papers resulted in twice the expected number of papers/demonstrations.

The first session, a plenary session, was addressed by Roland Kaye, from the University of East Anglia, who described the role that the Computers in

Teaching Initiative Centre for Accountancy (CTIAC), funded jointly by the Computer Board and the ICAEW, to be established at UEA, would play and the services it would offer the community in order to promote the use of computers in accounting teaching at Universities in the UK. It would act as a focal point and organise a bulletin board, newsletter, directory of software, regional service centres, training courses and seminars at the Centre and other institutions as well as a technical support service on hardware and software. He invited participants to make suggestions as to the way that the Centre could support the community. It was agreed by all who attended that this would provide a much needed service and impetus to the development of the work in this area.

Other papers and presentations included the following:

A presentation by G.WIlkinson-Riddle, Leicester Polytechnic Business school, of software that had been developed to teach book keeping and balance sheet analysis.

A paper by T.McElroy, D.Mutlow and N.Pratt, Ealing College of Higher Education, which described the development of the use of micro-computers on their degree course.

A paper by Professor K.Gee, Salford University, who explained the rationale and described the courseware that had been developed for a one term course on financial modeling.

A presentation by G.Brown, Napier Polytechnic of Edinburgh, of a building block approach to Lotus 123.

A paper by K.Aitchison and J.Innes, University of Edinburgh, on the use of Plus Plan for integrating computers into the teaching of consolidation.

A paper and demonstration by L.Thomson, University of Aberdeen, on courseware that had been developed for teaching BASIC which also taught basic accounting concepts.

A demonstration by D.Eadson, and K.Williams, Teesside Polytechnic Business School, of the use of Sage Accounting Package as a self learning package.

A paper by A.Pacitti, Glasgow College, on the use of software as the basic teaching medium.

A paper by Rodger Adkins, Salford University, on the Design Aspects of Teaching Spreadsheet Modelling.

A paper based on the Manchester University CTI project, which dealt with some of the issues involved in sharing software, both from the point of view of the author and the user.

The conference was marked throughout by a lively discussion in the breaks and following each paper. All participants remarked on the way that the University

reward system does not encourage endeavour in this area. They were extremely appreciative of the opportunity to identify other people developing work in this, much neglected, area. Such a well attended conference was a powerful boost to morale. Several themes and ideas emerged for a future conference, most notably more information about the different software that was available, its pros and cons, discussion about the educational practices that followed from introducing computers into the accounting curriculum and more opportunity to try out other people's software, preferably with the author, not just for the purpose of using it "as is" for teaching, but also for borrowing and developing the ideas behind it.

The intention was to allow the maximum possible "hands on" time to try out the software and to promote the interchange of ideas on the educational issues involved and the actual requirements of accounting teachers. However, considerable problems were encountered in mounting all the software on the right machines, despite the fact that the software had been sent on in advance. Further more, few of the authors sent one page summaries of how to use their software, with sample output, so that users could try it out on their own. This illustrates the real problems of portability and sharing in an educational environment. The time allocated for trying out software was, in the event, inadequate. A similar conference, held over two days, would enable informal presentations to take place in the evening in a less hurried atmosphere.

5.5.4 : British Accounting Association Conference

It was also hoped to promote such an interchange of ideas and software by using the annual conference of the British Accounting Association as the venue for a workshop on computing and accounting. This year the conference was held at Bath University and Professor Tomkin, the chairman of the organising committee, agreed to organise such a workshop. There was a lively interest in a workshop and this Department presented a paper on the use of informations systems for teaching.

As a result of both these initiatives, there are plans to publish some of the papers from both these conferences in a monograph which would be aimed at teachers intending to use computers in their courses.

5.5.5 : Presentations at Conferences/Seminars

Now that this project is well under way, there have been several invitations to present papers at conferences, both here and abroad. (Appendix XVI). Furthermore, papers have been given at research seminars at other Universities. (Appendix XVII). What has been particularly encouraging has been the invitations to other Universities and Polytechnics to give practical demonstrations to a group of teachers of the work that has been developed here. Several institutions have expressed an interest in having copies of our software.

5.6 Publication of Software

There does need to be a simple and cheap mechanism for sharing and

distributing courseware given that it cannot be published commercially. This issue has begun to be addressed. The Computer Board (CBURC) and Institute of Chartered Accountants of England and Wales (ICAEW) have recognised this need and have funded a resource centre (CTIAC) at the University of East Anglia that would address these very issues.

Their intention is not only to set up a database of accounting software for teachers (and where appropriate develop new materials) but also actively help other Universities in the integration of computers into the curriculum (Kaye 1989). Their feeling is that most accounting and finance courses could usefully incorporate one or two computer based case studies.

While clearly a register of accounting software would be very useful, at this stage it does not address the fundamental issue that it is not enough to simply have a register of software and a means of obtaining the software. Similar databases have become available in the US, (ISAAC, Wiscware) but the absence of explicit introductory documentation as to the software's aims, objectives, time required to be spent by the student, the level of knowledge required in relation to both the software and the substantive area of study, user instructions, teachers' manual etc., can make the use of such software more trouble than it is worth, as anyone who has attempted to make use of public domain software will testify.

What is needed at this stage of the process of integrating computing into the accounting curriculum is much more advice and support on the various problems encountered. As has been outlined earlier, what flows from the introduction of the new technology is a change in the social relations, organisational structure, educational methods, role of the teacher, etc. Most attempts at integration flounder for precisely these reasons. The organisational difficulties encountered are not unique to Manchester University. In fact Gardner (1988) reported that 45% of the 106 CTI projects questioned about the problems they were facing identified problems that can best be described as "organisational" rather than "technical" in character.

This implies that the main medium for the exchange and sharing of software will not be a register of such software, but conferences, workshops and Open Days at institutions that have had some experience in using accounting courseware, as well as the development of journal supplements and software reviews in existing journals.

It should be clear by now that it is completely utopian to expect to be able to make use of other people's software without first acquiring some computing knowledge. After all, one wouldn't expect to teach accounting without having first acquired the technical knowledge of the subject. It is important to disabuse those teachers who have either never used a computer or have never used a computer for teaching, of the notion that it will be easy; firstly to find the courseware they want (their needs and constraints are always different and unknown/unknowable to the authors); secondly to alter it (modifications to software are nearly always a messy business); thirdly to be able to implement it without hassle (access to and administration of the computing facilities is no small question); and lastly to be able to use it without disrupting the existing curriculum.

It is therefore important for those institutions just embarking on the use of computing in accounting teaching, **that the issue of raising the level of computing literacy among its staff is tackled**. It is not enough to show them how to use spreadsheets, database management systems, etc., but also the operating system, how to transfer files, the different design issues involved in educational computing and the educational practices and organisation that follows from using computers for teaching purposes. That is, it implies knowledge on a wide variety of fronts. **Above all, much more institutional support and resources are required if work of this nature is to be pursued.**

This further implies that those who give papers and demonstrate their courseware at conferences, workshops and Open Days, deal with these issues from a number of perspectives. Firstly, why they took their particular approach, their constraints and objectives, what they learned and how they would do it next time. Secondly, what educational practices and organisation follow from the use of their courseware. Thirdly an explanation of the courseware itself, conceptually what it is doing, because courseware from another discipline entirely, e.g. town and country planning, may be of interest in terms of its form, if not its content, as a source of ideas. The organisers of such conferences, workshops and Open Days should make it clear, in advance, what approach or perspective they are taking, while the audience too, in order to be able to participate fully, should also indicate why they are interested.

It is therefore proposed to publish the software developed as a result of this project, via CTIAC, but it must be said that much of the software developed can only be described as illustrative and exploratory rather than as definitive teaching tools or final products.

5.6 : Conclusions

It should be clear from the above, that although one of the objectives was to disseminate the courseware so developed as a result of the CTI grant, it is far from clear that all the materials warrant publication and that other teachers are willing or able, for a whole number of reasons, to make use of them in their courses. Courseware produced by enthusiastic academics/teachers is rarely usable by others. This was found also to be the case for materials published commercially as was seen at the conference. Furthermore, it is extremely time consuming to test out other people's software. Most people chose software on the basis of word of mouth recommendations. **It is suggested that the major value in circulating software lies in the ideas and concepts embodied in the software rather than in the software** *per se*.

Chapter 6 : Evaluation

This chapter seeks to evaluate the contribution the CTI grant has made to the integration of computing into the accounting curriculum and to bring out some of the general issues and problems encountered. It describes the problems installing the network, implementation and the evaluation of the courseware in relation to the three objectives of using computers for teaching.

6.1 Installation of the Network - some General Points

It is important to draw out some of the general issues arising out of the problems encountered in setting up the computer laboratory within the Department, so that others may profit from our experiences. After all, to understand, one has first to have failed to understand!

The dependence on UMRCC for technical knowledge and assistance to install the network was the result of the fact that the research grant did not bear the full cost of the project. This was to be part of the University's contribution and commitment to the project. It was in fact a major task for UMRCC and had to be fitted into the existing workload at a time of continuing financial cutbacks.

Any future project requiring substantial resources from a University department should endeavour to get additional funds so as to avoid dependence on an already stretched service. In fact, at the University of Minnesota, at Minneapolis, which has a similar network to ours, where the author of this report was visiting in summer 1986, the Department Of Information Systems expressed surprise that we were even embarking on such a project without in house expertise. **We would explicitly recommend that where time is of the essence, funds should be set aside for the University to be able to hire extra technical staff.**

In any event it is not at all clear that the initial objectives of the project could not have been achieved without a network system. Most other University departments in the US have hard disc stand alone systems. This means that databases, programs, etc. would have to be loaded onto each computer and would therefore be less easy to maintain. However a stand alone system has the advantage that it can be added to incrementally as the resources become available. In fact, the University as a whole has standardized on stand alone hard disc Pcs which permits different software to be mounted on each and for the software to be changed from machine to machine as appropriate, saving a considerable amount of money.

One of the reasons for having a networked system was that it permitted access, via the file servers, to the University Of Manchester Business School's IBM mainframe system and to the software that they were developing. It would also permit access to the UMRCC's mainframes and the software, e.g. electronic mail, linear programming, statistical analysis packages, etc.

To date, however, the networking to the Business School's IBM and to the

University's mainframes has still not been done for a number of technical reasons and it is not at all clear that it can or will be done. It was also intended to link computers in staff rooms to the network. This was delayed because no funds were available for staff machines or for the technical staff to do it. It was eventually done during the autumn of 1988.

While the possibility of linking the network with the mainframes on campus was likely to be an advantage in the longer term, the networking caused considerable delays to the start of the project. The decision to network had implications for the choice of software. Networked versions of the commercial packages were not yet available, despite repeated assurances they would soon be on the market.

In order to avoid any corruption to the data files, the ability to write or even format a disc has been disabled from any machine but the fileservers (whose keyboards are kept locked). Thus many potentially useful features of networking are not in fact used!

Another major problem encountered was the lack of financial assistance from the University for the running costs of the computer laboratory. In the past, computing facilities have been centrally funded by UMRCC, not by the individual departments. Non-science departments have no budget allocation for either technical assistance or the running costs of equipment. An application was made to the Faculty for the estimated running costs of #1,000 per annum for paper, ribbons, discs etc. The initial response was that the maintenance costs for undergraduate teaching with computers should be met by the Department putting on courses for the community at weekends! This has now been resolved, but it is an indication of the difficulties faced by decentralising computing resources within the University without making additional funds available. The capacity of the University system to respond to these additional demands is very limited in the face of increasing cut-backs. This imposes a major constraint on the ability of the teaching staff to innovate.

6.2 : Implementation Issues

An additional problem encountered was that it was very difficult to involve staff members, other than those directly involved in the project, in the development of course materials, in advance of the network actually operating. In part this is a reflection of the current University reward system, with its unremitting pressure to engage in research that permits frequent publications in academically approved journals, which does not actively encourage commitment to and the development of teaching materials, computing or otherwise.

More importantly, it was also a consequence of the staff's lack of knowledge about computers and their uses in accounting and education in general. A workshop on Lotus, the primary software tool in business and accounting, was organised. But this was insufficient to show them the educational value of computing.

It had always been made clear that the actual development of the software, that is the programs, data and Lotus templates would be done for them to their

specification. But even to specify what was required implied an understanding of its educational value and the capabilities of such programs, etc.

The frequent request was:

"Let's see the system up and running, what it can do etc, before we embark on anything too ambitious."

Other comments included:

"Even if we set work for the students to do using computers, there isn't enough equipment for them."

"If we set work for them, using Lotus, who is going to teach them Lotus in the first place, and who will help them with the inevitable queries?"

What lies behind all these comments is of course the fact that consciousness follows social being. Staff cannot be expected to understand the implications and value of computers in education if they have no access to computers. In the US, the practice has been to put computers on to every member of staff's desk **before** attempting to integrate computing into the curriculum. **i.e. in order to develop and use computer based teaching materials, staff must be given a computer. In fact we would make it an explicit recommendation for any similar such project.** In this project, the computers were made available to students first and only to the member of staff, and belatedly at that, directly involved in the project. To a large extent, every one who wants a computer on his/her desk, for teaching, research or word processing, now has one.

Furthermore, attention has to be given to the question of staff development and training in the new technology. It had not been envisaged that a major part of the project would involve staff training. In any event, this is beyond the capabilities of the research project as initially set up. It is an organisational question that has to be tackled by the University system as a whole and cannot be done by individual departments although clearly they should take a lead in specifying what it is they require in terms of training.

The University of Manchester is unusual in that it does have a central service, the Staff/Teaching Workshop, whose function it is to provide that training. Lunch time sessions are organised on topics suggested by individual members of staff and the whole University is circularized. However departments as a whole have no plan or overall strategy for the needs of their department or individual members of staff. In any event the funding of the Staff/Teaching Workshop as presently constituted is inadequately funded to respond to such a demand.

In relation to the use of computers in education, there is a further organisational complication. In the past, and certainly at other Universities, it has been the computer centre that has taken the initiative in computer training for staff and put on courses of general interest and application. Again, this has been another casualty of the cuts, although at Manchester, the situation was further complicated by the fact that the UMRCC provided a

general service to all the Universities it served and had no resources, until very recently, for a local service to Manchester University staff! The Staff/Teaching Workshop has now assumed that function in the relation to training staff in computing developments.

There were a number of other reasons for the unwillingness of staff to be involved in the project. It was also in part due to the way that the project got under way. Given that it was the intention to expand the use of computing, an application had been made to the University for funding of a computer laboratory. In the event, the funding came from the Computer Board, but the orientation and management of the project did not change as a result of this.

From the start, it was seen by the Department as being related to the teaching of one of our existing courses about computers. It was viewed as simply a way of obtaining additional computer hardware for the Department as a whole. Because of this, there was considerable resentment about the reduced teaching allocation for the project staff, the lack of computers for staff members, etc. They did not appreciate the implications for them. There was a general lack of understanding within the Department as a whole as to what was involved and the commitment to the Computer Board.

The project was run along the lines of the conventional research paradigm. That is to say, it was managed in the non-directive way that is the normal custom and practice of University grants. This conception was reinforced by the fact that there were no negotiations with any external sponsor. Having previously worked for many years on large-scale, Government sponsored research, the project staff were used to regular meetings with the "customer" so that all involved knew what was required. This did not take place in relation to this grant from the Computer Board. Little appeared to be required of the University as the grant holder other than interim and final reports.

The first contact was made, only incidentally, in April 1988, as a result of a telephone request for further information about accounting software databases. It was only then that it was learned that the CTI were placing a growing emphasis on effective project management, clearly defined goals and deadlines, positive evaluation strategies and full reports.

In the absence of this external direction, and the relative unwillingness of staff to be involved in computer based case studies (a very widespread problem), the emphasis of the project was on the development of software. The approach taken was to involve only those who were interested in the project rather than actively involving the whole department. Any other approach would have involved a much more directive policy in relation to teaching than is the norm within Universities.

This is now changing as the project staff have seen the implications and applications of different types of computer based courseware, as the other members of the staff have seen the different ways that computers can be used in teaching and new staff are being recruited who are interested in these questions. The greater availability of hardware and software, and the evident interest of the students have also been important factors. Furthermore, factors such as the increased use of computers in the commercial world and at

other Universities which see information technology as a marketing feature to attract students to their courses, will also be important.

To conclude, this section of the report has endeavoured to discuss the underlying causes contributing to the problems in starting the project. The causes were financial, technical and organisational. But in the last analysis, the technical and organisational problems are a reflection of the financial stringencies imposed on the public sector. To a large extent this was implicit in the Computer Board/UGC setting up the CTI projects in the first place. It implied a recognition that the Universities could not otherwise have made the resources available to departments to explore the new opportunities presented by computers.

6.3 : Evaluation of the Courseware

In view of the nature of the project, the issue of evaluation was seen in the original project proposal as being a difficult one to define. There are several aspects to evaluation. There is first of all the question of lesson evaluation and revision. Courseware needs to be tested thoroughly to ensure that it operates properly and that it deals with the subject matter in an academically sound way. This includes checking the supporting documentation and user instructions. Secondly it needs to be tested with small groups of students to get their response and ascertain which parts of the software is not clear, etc., with a view to revising its before it is used with a large group of students. Thirdly an assessment needs to be made as to how well it operates with a large number of students, e.g. whether the computer's response time is too slow with a large group using it simultaneously, and how well it accomplishes the instructional objectives.

Given that the aims of the project are to introduce students to information technology as a management tool and thereby to integrate it into the curriculum, it would seem logical to evaluate such materials as are developed by the extent to which they are actually made use of, the extent to which students are able to learn new computing skills without further formal instruction and do in fact promote the learning of principles and concepts taught on the core accounting courses. Furthermore, it is not enough to be successful in achieving this objective if as a result students never want to touch another computer again! i.e. The criteria of its effectiveness are the take up rate by staff, and students of similar courses and the transfer of learning it permits.

While it is easy to specify these criteria in general, it is less easy to specify objective performance indicators of either criteria that are in fact practicable to measure. For example, the rate of adoption by other Universities will be affected by factors other than the educational value of our materials, e.g. local hardware and software compatibility, the extent to which their courses are similar to ours, availability of in house expertise to develop their own software, etc.

Likewise while it is in principle possible to compare examination results from year to year in order to ascertain whether performance has improved, it is very difficult from such empirical studies to assess the causes of any such

differences (statistically significant or otherwise) that are observed. Since the content of examinations vary from year to year and in effect examination marks are normalised, comparison of examination results on an annual basis may not be a very useful measure of the degree to which computer based instruction has achieved its objective.

Thus such measures as can be used to assess its effectiveness are likely to be very subjective. Where subjectivity is unavoidable, what is at issue is the relationship between subjectivity and objectivity.

The newer applications software has on the whole proved popular with the students and much more popular than the programming part of the course. It is worth noting in this context, that the programming courses are usually the least popular part of their degree courses, not just at Manchester University but elsewhere in the UK and the US. To a large extent their perceptions of the value of the course are influenced by the fact that they know that employers are increasingly requiring skills in IT. One factor that is involved in students' choice of University is the degree to which they will be adequately prepared for the job market. This is a matter of particular concern for foreign students.

However most of the students reported that they had had insufficient instruction and practice in Lotus. A major constraint was, as expected in the first year, the lack of computers with the required software. Given that the computers were being used for five courses and some assignments could only be completed on the Department's network, there was little extra capacity for using them on the other courses. Most of the second year computing course BASIC assignments can be done on other Pc clusters around the University. dBASE is available on one other, much used, cluster.

However as a result of strenuous pressure from this Department, the University decided to standardise on the spreadsheet and database management systems used by our students and sanctioned the purchase of forty copies of both Lotus and dBase for other Pc clusters around the University which were available for student use in October 1988. Thus to a large extent these problems were not encountered in the second year.

The problem of access is not however simply one of access to the software. There is also the problem that students are denied access to most clusters outside normal office hours. Because of the financial cutbacks, portering and security staff hours have been cut. Discussion is now going on about the siting of new clusters of Pcs, with the relevant software, in the Library where the opening hours are longer than most University buildings. Furthermore, as electronic security systems have been now installed, students will have access to the computers even when there is a reduced level of security staff on duty.

Students have difficulties with the operating system, discs, printers, software etc and need additional support when using computers outside regular class time. This has therefore increased the load on those members of staff who have expertise in computing. These queries could more usefully be dealt with by a demonstrator than a teaching member of staff, but additional

resources are necessary to finance this.
It is apparent that both the second year students' projects and the third year Computer Science and Accounting projects have improved during each of the two years of the project. It is not clear, of course, the degree to which the increased experience of the staff in setting work which more realistically matched the capabilities of the technology and student skills was responsible. Furthermore, in the case of the third year Computer Science and Accounting students, the second term's work is in general was substantially better than the first term's work. To a large extent this is because the students and staff have a clearer understanding of what can be achieved by the system.

It can confidently be expected that next year's work will be better again as the project specifications and required methodology improve. Furthermore, the use of an oral examination/presentation for the second year projects (Computer Science and Accounting students only) enabled the students to see for themselves what was required of them. i.e. The assessment method gave them some feedback about their performance and was itself an instructional aid.

The take up of the courseware by the other members of staff will to some extent depend on the perceived usefulness of the case studies that have been developed and the students' responses to them. Computer based case studies and exercises impose enormous opportunity costs on both the staff and the students as the work is both time consuming to develop and to do. It can only be justified if it can be seen to be not only effective in educational terms but also effective relative to the opportunity costs of not doing something else. Most of the staff do not feel that in the present climate, the additional time spent developing, learning how to use courseware, staff/student contact time and above all the extra time spent marking is worthwhile.

When the proposal was written, it was envisaged that the real test of the project's success would be from the employers' evaluations of accounting graduates. But it is inevitable that it will take place over quite a long time scale as students pass through the Department and into employment.

Discussions with the recruiting managers of the major employers have taken place regularly. They expressed their preference for students who had some familiarity with information technology, and had done project work. They particularly stressed the desirability of group project work. This was confirmed by students' reports of their interviews. Several employers remarked that our graduates were noticeably better prepared in relation to computing skills than other graduates. An increasing number of employers are offering summer vacation work to second year students, particularly to the Computer Science and Accounting students who have acquired significant relevant computing skills. Some indication of the employers' evaluation of the usefulness of the project can be gleaned from the fact that funding and consultancy was obtained from one of the professional institutes and firms within a few weeks of asking for it!

To conclude, while a project of this sort does not readily lend itself to objective performance indicators of effectiveness, the issue of effectiveness is a major question. Computer based exercises and case studies are expensive to develop and maintain and impose significant opportunity costs on both staff

and students. As Seddon (1987) explained, computer based instruction as an educational aid, can only be justified if students can learn more in the same time using computers than they can by other methods. Computer based instruction, in general, has been characterised by the misdirection of enthusiasm and the institutionalisation of mediocrity (Self 1985). **There is no question but that their computer literacy and knowledge about computer systems and the relevance for accounting has improved far beyond the level achieved using mainframes.**

As a result of introducing students to information technology in the second year course, it can be stated that students were able to acquire new computing skills, e.g. the use of dBase in enquiry mode, without further formal instruction, simply with an introductory handout. No problems were reported with it, (other than one caused by a "typo" in the handout!). Teachers who required students to use computers on their courses to develop their own models found a marked improvement. Other teachers, e.g. in Economics where courseware had been designed to aid the learning of concepts, noticed that students more readily grasped the concepts than previously.

Chapter 7 : Conclusion

The first phase of the project was primarily concerned with setting up the computer network so as to provide students with an integrated study environment in which they can become familiar with computer applications in business and gain some experience of commercially available software.

The second phase was concerned chiefly with the development of computer based materials for tutorials and the issues raised by attempting to integrate computing into the curriculum.

The third phase was spent developing the management accounting database, exploring and developing additional materials, using and testing materials that have already been developed and promoting discussion among the wider community about our experiences and the developments we have made.

Already, it is possible to see the advances that have been made and the interest it has aroused in the community at large. The author has been asked to present papers at conferences, both here and abroad, and was also invited to Canada to discuss the work being done here.

The work has several features that are novel and are of interest to other accounting teachers. Firstly, the scale of some of the individual items of courseware being developed, being very modest, enables others to make use of the approach we have taken. (Much of the work in the USA is either keystroking or extremely ambitious). It also means that any such courseware may be very much easier to integrate into the curriculum than a major piece of software, requiring several tutorials if it is to be covered properly.

Secondly, a major focus of emphasis has been on the educational aspects and the issues of integration and implementation rather than simply the computing and technological aspects. The use of computers for instructional purposes requires an orientation towards the learning process itself.

Thirdly, the courseware has, to some extent, been developed through the teaching process itself, i.e. by students and staff, rather than by the staff alone. The development of computer based courseware is a daunting task for those who do not have either the time or the expertise to develop it themselves. Getting students to develop the models as part of the coursework has some obvious advantages (as well as some disadvantages.) This method has only limited uses, but has at least opened up a route for some work to be developed in this way.

By taking this approach, it has been possible to develop courseware that is or is likely to be of use in teaching accounting. As in all other development of computer systems, the products were always much more useful and usable, when the users participated actively in the design process. i.e. The question of user involvement is absolutely crucial to good courseware design. Other work, which may not be of direct use, has enabled us to explore many of the issues related to educational computing and thus has enriched our understanding of the area.

The major area of development made possible by the CTI grant has been the management accounting database. As a result of the work done so far, funding has been obtained for further research into the use of databases for teaching. It is intended to develop a computerised database that can be used by both teachers and students on accounting courses as a study resource. The first stage is to develop the software that would enable it to be used as the basis for tutorial exercises for the whole of a second year management accounting course. Its significance and value lies in the fact that it would enable students to solve traditional management accounting problems with a realistic set of data and to compare their answers and solutions so obtained with what actually occurred. Thus the whole course could be focused around a real company.

Although the database would be stored on computer files, the purpose is not to teach computing skills but accounting principles and concepts. By requiring students to make use of a computerised database as an integral part of their work, it is hoped that they will learn to use computers in a more realistic context, their uses, both potential and actual, and their limitations and perceive the necessity for acquiring the appropriate skills. Previous research and development, both in the UK and abroad, have stressed computer aided instruction techniques, the role of the computer as a calculator and its use for model building, etc., (all valuable in their own right) rather than its use for information retrieval in problem solving.

At a recent conference in Canada, a paper (Richardson and Stein 1989) described an attempt to simulate a database for activity analysis. While the ideas were very interesting, its design and execution had severe limitations as they had used inappropriate software tools. Nevertheless it was encouraging to see that others recognised the value of such a database. Furthermore, it is a University with which we have extensive research contacts. As yet, no one else has developed an accounting database that can be used for teaching purposes. Commercially available systems do not lend themselves to this.

The purpose of the project is to develop the database for the remaining part of the second year management accounting course and the third year course and the associated software for both the teacher and the students. This would provide the basis for fifteen tutorials relating to: job and process costing, strategic management accounting, pricing and marketing, finance and capital budgeting, financial accounting, divisional performance evaluation and the use of OR techniques.

This will require extensive discussions with the accounting teachers to ascertain their precise teaching objectives and the consequent data requirements. Peat, Marwick, McLintock have already played a major role in providing the data for the existing database and have indicated their willingness to continue to be involved in the project by providing a member of staff to assist with this and to liaise with the project staff to advise them during the preparation of the database. That person would also be involved in these discussions.

Once a start had been made on the data collection, the systems analyst/designers would start by first of all assessing both the technical and operational constraints in setting up the database and their implications for the design of the system. They would then, after further consultations with all the staff involved in the project, start work on the database and the accompanying software. The project staff who will be working on the database are the same students who developed the initial system.

A major part of the work, and indeed a major feature of the existing system, is the design of a very good user interface, which would enable the students to select the data that they needed, in the right order, without access to subsequent data which would negate the pedagogic value of the exercise, and transfer the data to Lotus templates.

While the emphasis would be on the students solving the problems manually in the first instance, it is envisaged that in some cases Lotus templates would be designed to enable them to do sensitivity analysis. The design of the templates, that is, with or without the formulas, would depend on the educational objectives of the particular tutorial exercise. Graphing might be appropriate in some cases. It is not the intention to prepare computerised, self teaching packages on any of the topics. Worked solutions, based on templates, would be made available to students at a later date, as appropriate. This would enable them to practice the particular technique with a different set of data.

A later phase of the project involves the preparation of very good documentation, at a variety of levels, for the teacher. This would also enable a teacher who is interested in adapting the system to his/her own needs and has access to the relevant computing expertise, to do so. It is anticipated that the major way that the system will be used by other teachers will, in the first instance, be as it it stands. It is unlikely however, that another teacher will necessarily, use all parts of the system, as management accounting courses vary from institution to institution. It is envisaged that a database such as this will be of interest to many accounting teachers and will stimulate a lively interest in the innovative ways that computers can be used in such courses.

The software would be made available to other educational institutions. Consideration would have to given as to the form of the software, but it is envisaged that it would be made available either as a suite of dBase III+ programs (dBase being a widely available database system) and/or in a compiled version which would be faster to use and means that the user would not have to have dBase on the machine. Since it is written for an IBM Pc compatible machine, with a hard disc, it will be a very portable, although large, system.

As has been stated, the purpose of this research is to develop a database that can be used on the second year management accounting course at Manchester University and that could be used elsewhere. The database would also be suitable for third year and short courses in management accounting and other courses such as finance and financial accounting.

It can be anticipated that the design and implementation of the second year

management accounting database will provide extremely useful insights into the issues involved in the use of computers for information retrieval and problem solving in the educational context and will enormously expand our knowledge in this area. This will have implications for the use of such systems in areas other than accounting and business.

It is perhaps useful at this point to return to our initial objectives and intentions at the outset of the project. It had been expected that it would be easier to integrate computers into the curriculum by preparing course materials that could be used to cover one topic of concept on an existing course rather than the whole course. It is noticeable from our work that this approach was not particularly successful. The technology changes what can be taught as well as the methods. Consequently the piecemeal approach is not necessarily applicable. It involves a qualitative change, entailing a break with past methods and procedures.

The pump primimg to enable a Pc lab to be housed **within** the Department has provided a valuable resource for our students. Without this funding, it would have taken until 1989, i.e. two years later to mount similar courses to those outlined above. Furthermore, obtaining these resources ahead of other Arts/Social Science Departments in the University (despite certain disadvantages) meant that we were more able to make additional requests for software and hardware and to influence policy. Having a Pc lab within the Department for the first time, meant it was easier to schedule regular classes (AC 200), occasional classes (AC 305 and AC 307) and supplementary classes and advice sessions, as the need arose. i.e. It is easier to integrate computing into the curriculum if one has Departmental control over a cluster of Pcs within the Department rather than simply the use of a University cluster, usually in another building, available for general use.

The CTI project has resulted in a more effective accounting information systems course. It aims to teach computer literacy and computer systems. This in turn has made possible the use of computers to aid students acquire and apply techniques and concepts taught in the core accounting courses. It has also enabled a closer integration of the two parts of the joint Honours degree in Computer Science and Accounting. Lastly, the project has resulted in a much greater understanding of the issues involved in disseminating and using other people's software.

We are only now gaining the experience that may lead to the effective production of courseware. It is a lengthy process and we are only just beginning to understand it. Future work will be able to take advantage of the superior hardware: colour, enhanced graphics and parallel processing to aid students' comprehension of abstract concepts. The costs are far from trivial and will require additional sources of finance. The effect of the new technology in teaching is bringing about an analagous situation to that obtaining in manufacturing industry. Direct costs, in this case teaching time, will decline relative to fixed costs, equipment, but more importantly, the production costs (of teaching undergraduates) will decline relative to development costs. It will entail a change in the teacher's role from delivering information to designing courseware as part of a team.

The achievements of this project do not appear to be substantially different from those reported in the CTISS file. Bork (1981, 1985) drew very similar conclusions and made a number of important recommendations, all of which are endorsed by this report. Output from CTI projects such as this is not simply the amount of really useful software, but an analysis of what constitutes useful software and the process by which it can be achieved. Research of this sort combined with continued and secure funding should enable work to proceed on a more scientific basis. This has been the major value of the CTI project.

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Shaoul, J.E.,(a), "Impact of new technology on accounting education", paper presented at International Business Schools Computer Users Group, April 1988

at INSEAD, France.

Shaoul, J.E. (b),"The impact of New Technolgy on the Curriculum and Teaching Methods in Accounting", paper presented at the British Accounting Assocaiation Conference, at Tent Polytechnic, Nottingham, April 1988.

Shaoul, J.E. and Smith, P.J., (c), "Expert Systems or Proficient Systems? The Calculation and diagnosis of Standard cost Variances", Paper presented at the Fifth International Conference of Education and Technology, at Edinburgh University, March 1988.

Shaoul, J.E. and Smith, P.J., (d), "Expert Systems - a Competent Tool for Training?" Paper presented at the International Business Schools Computer Users' Group At INSEAD, France , April 1988.

APPENDICES

I Uses and Applications of Computers in Accountancy Firms

II AC 200 Workshop Exercises - B.A.Econ

III AC 200 Course Assessment - Stock Recording Project - B.A.Econ

IV AC 200 Workshop Exercises - dBase version for Computer Science and Accounting

V AC 200 Course assessment - Stock Recording System - for Computer Science and Accounting

VI AC 200 Case Study for Summer Examination 1987

VII Plant Closure Model

VIII Inventory Management Plan for Summer Examination 1988

IX AC 202 Management Accounting Exercise 1987-88

X AC 202 Management Accounting Database

XI AC 305 Kensington Case Study

XII AC 307 Feasibility Study

XIII CS 301 Computer Science and Accounting Assignments

XIV List of Courseware

XV Description of Courseware Developed

XVI List of Papers and Presentations Relating to the Project

XVII Papers Presented at Research Seminars

XVIII Support given by the University and other sources

XIX Final account as at June 1988

XX Personnel Involved in the Project

Appendix XIV
Courseware Developed

1. Stock recording system and associated data files for AC 200
2. Plant closure model
3. Tax revenue generator
4. Model showing the relationship between different sales patterns and working capital
5. Gilt models
6. Fixed cost allocation - using three methods
7. Calculation and diagnosis of standard cost variances
8. Analytical review of a company
9. Portfolio game
10. Hospital Management game
11. Trial Balance adjustment package
12. Management Accounting Database
13. Impact of Interest Rates on Income Distribution
14. A Comparative Advanatage model
15. Joint Cost Allocation Model

Appendix XVI
Conference Papers and Publications relating to the Project

SHAOUL J.E. "The impact of New Technology on the Accounting Curriculum." Paper presented at the 5th International Conference on Technology and Education, Edinburgh University, March 1988 and published in the conference proceedings.

SHAOUL J.E. and SMITH P.J. "Expert Systems : A Competent System for Training?" Paper presented at the 5th International Conference on Technology and Education, at Edinburgh University, March 1988 and published in the conference proceedings.

NEWMAN M., O'HARA M.J. and SHAOUL J.E. "Incorporating Project Work into Information Systems Development Teaching : One Department's Experience." Paper presented at the ISTIP Conference (Information Systems Teaching : Improving the Practice), at the Civil Service College, Sunningdale Park, Berkshire, March 1988.

SHAOUL J.E. "Impact of New Technology on Accounting Education." Paper presented at the European Conference of the International Business Schools Computer Users' Group, at INSEAD, Fontainbleau, April 1988.

SHAOUL J.E. and SMITH P.J. "Expert Systems or Proficient Systems - the Calculation and Diagnosis of Standard Cost Variances." Paper presented at the European Conference of the International Business Schools Computer Users Group, at INSEAD, Fontainebleau, April 1988.

SHAOUL J.E. "The Impact of New Technology on the Curriculum and Teaching Methods in Accounting". Paper presented at the British Accounting Association Conference, at Trent Polytechnic, Nottingham, April 1988.

SHAOUL J.E. "Educational Implications of Integrating Computing into the Accounting and Business Curriculum". Paper presented at the International business Schools' Computer Users Group, at Miami University, Ohio, USA, July 1988 and published in the conference proceedings.

SHAOUL J.E. "Integrating Computers into the Accounting Curriculum Using an IBM Pc Network". Interim Report to the Computer Board, Manchester University, June 1988.

SHAOUL J.E. "Sharing Accounting Courseware". Paper presented at a conference on "Sharing Accounting Courseware" at Manchester University, March 1989.

SHAOUL J.E. "Accounting Information Systems Course - the Trojan Horse". Paper presented at the British Accounting Association Conference, Bath University, March 1989 and published in the conference proceedings.

To be published in a mongraph by Academic Press.

SHAOUL J.E. "Teaching With Computers". Paper presented at the 12th European

Accounting Association Conference, Stuttgart, Germany, April 1989.

SHAOUL J.E. "Innovations in an Accounting Information Systems Course". Paper presented at the Workshop on "Innovative Applications of Computers in Accounting Education" at the University of Lethbridge, Alberta, Canada in May 1989.

In addition, this will be published in a monograph by the University of Calgary Press.

SHAOUL J.E. "Innovations in an Accounting Information Systems Course". Paper presented at the 1989 Annual North American Conference of the International Business Schools Computer Users Group, at Penn state University, July 1989 and published in the proceedings.

Appendix XVII
: Papers Presented at Research Seminars

SHAOUL J.E. "The Impact of Microcomputers on the Accounting Curriculum". Research Seminar given at Glasgow University, February, 1988.

SHAOUL J.E. "The Development of Computer Based Case Study Materials for Accounting." Research Seminar given at Napier College, Edinburgh, March 1988.

SHAOUL J.E. "The Development of Computer Based Case Study Materials for Accounting". Research Seminar given at the University of Wales at Aberystwyth, April 1988.

Appendix XVIII
Support Given by the University and Other sources

Institutional Support given by the University :

1. Technical support for the installation of the network from UMRCC

2. Recurrent grant of £1000 p a for paper, ribbons etc;

3. Basic maintenance of equipment by UMRCC;

4. Advisory service to students from the Research Support Unit, Faculty of Economic and Social Stidies;

5. Staff time : Dr. Jean Shaoul to develop courseware;
Mr. Mike O'Hara to manage the network and provide technical assistance;

6. Study leave to Dr. Shaoul to visit colleagues in the USA, do research and attend conferences in 1986, 1987, 1988 and 1989.

7. Contribution towards the cost of attending :

British Accounting Association Conference at Glasgow University, Glasgow, 1987.

The International Business Schools' Computer Users' Group Conference at Miami University, Oxford, Ohio, 1988

British Accounting Association Conference at Trent Polytechnic, Nottingham, 1988.

British Accounting Association Conference at Bath University, Bath, 1989.

European Accounting Association Conference at Stuttgart Germany, 1989.

The International Business Schools' Computer Users' Group conference at Penn State University, USA, 1989.

8. Facilities of the Staff/Teaching workshop.

Additional Sources of Support have been received from:

1. Touche Ross and Co - £3500, as a contribution towards the cost of Dr. Shaoul's expenses in the USA, 1986.

2. Peat, Marwick, McKlintock's staff time to collaborate with the Department to develop the management accounting database.

3. Esso Ltd - £2500 towards the cost of the subscription to Datastream, the financial database.

4. Arthur Young & Co - staff time to help with the development of a small corporate database.

5. Deloitte, Haskins and Sells - cost of maintaining a library of computer journals

6. Arthur Young & Co - the cost of annual prizes for the best computer projects for Ac 200.

7. Coopers and Lybrand - for their pre-audit software

8. Touche Ross & Co - #1,000, as contribution towards the cost of Dr. Shaoul's expenses in the USA in 1988.

Appendix XIX
Final Account as at June 1988

Hardware	£44,203
Software	5,566
Electrical Installation	1,894
Network wiring	337
	52,000

Appendix XX
Personnel Involved in the Project

Project Director :

Head of Department of Accounting and Finance
Manchester University,
Manchester M13 9PL.

Tel No: 061 275 4011

1986-87 Professor R.W.Scapens
Jan 1988 -July 1988 Professor A.J.B.Hope
August 1988 - Professor R.W.Scapens.

Development of courseware :

Dr. Jean Shaoul
Lecturer in the Department of Accounting and Finance
Tel No : 061 275 4027

Manager of Computer Network and technical support :

Mr. Mike O'Hara
Lecturer in the Department of Accounting and Finance
Tel No : 016 275 4012